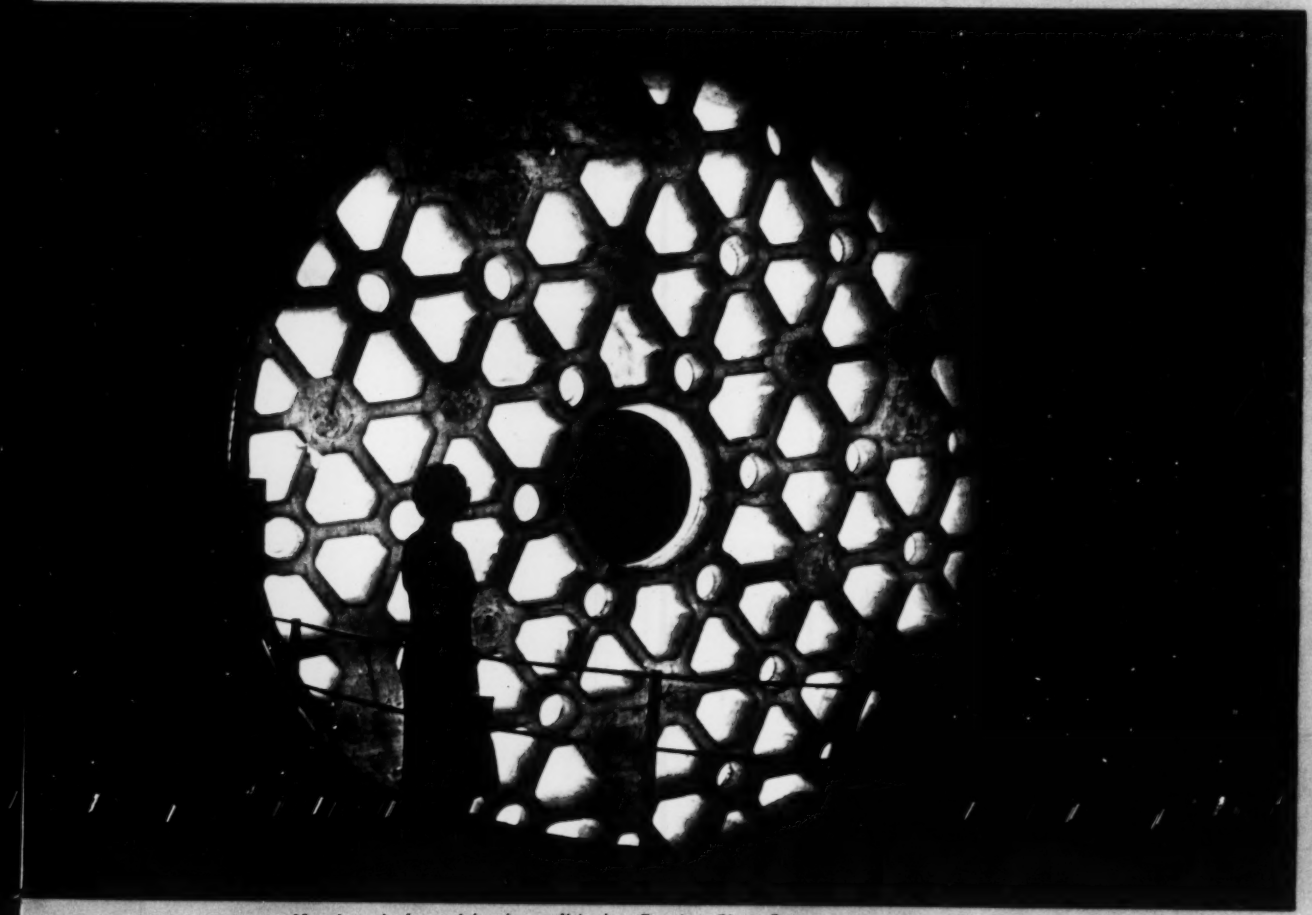
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

SEPTEMBER ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 119—Journal Section of The American Society of Heating and Ventilating Engineers



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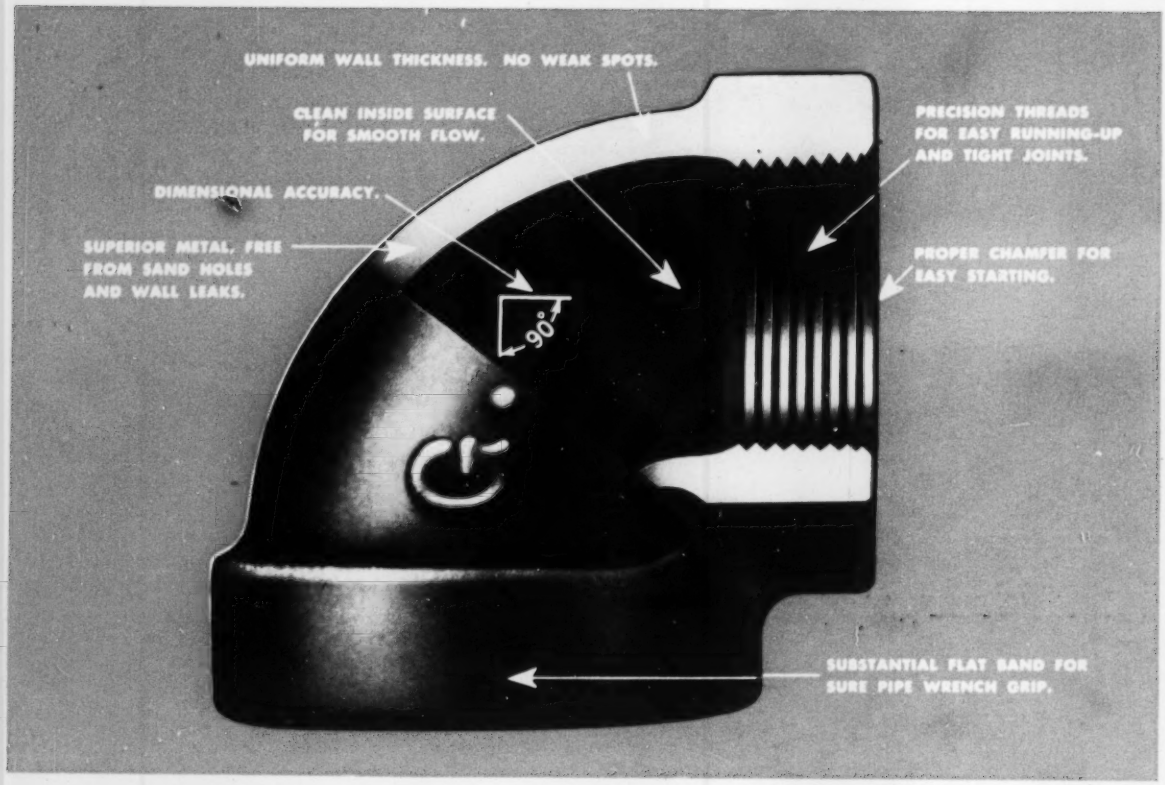
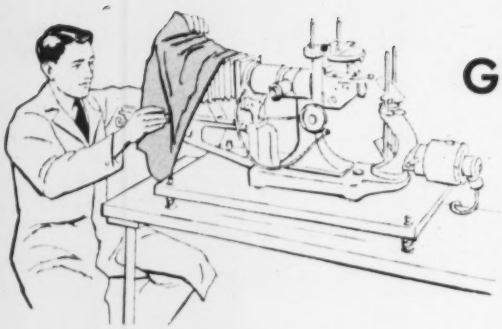

UNIFORM WALL THICKNESS. NO WEAK SPOTS.
CLEAN INSIDE SURFACE FOR SMOOTH FLOW.
PRECISION THREADS FOR EASY RUNNING-UP AND TIGHT JOINTS.
DIMENSIONAL ACCURACY.
SUPERIOR METAL, FREE FROM SAND HOLES AND WALL LEAKS.
90°
PROPER CHAMFER FOR EASY STARTING.
SUBSTANTIAL FLAT BAND FOR SURE PIPE WRENCH GRIP.

Rigid Inspection

From foundry to finished fitting—modern inspection methods insure the quality of

GRINNELL PIPE FITTINGS



The "Photomicrograph"
By means of photomicrographs, the metal structure of castings is thoroughly checked for full information on production quality.

For instance, for malleable fittings, laboratory technicians make an hourly chemical analysis of foundry metal to insure uniform, high quality. Daily tests by photomicrograph reveal metallurgical structures. Sample bars from each melt are subjected to tensile strength tests . . .

Fittings must pass a 100% inspection both before and after machining. Quality control includes alignment tests, high pressure hydrostatic tests, and comparator checks on the accuracy of threads and chamfer.

That's why, when you specify Grinnell cast iron and malleable iron pipe fittings, you are sure of —

- High quality metal
- Dimensional accuracy
- Clean inside surface for smooth flow
- Proper chamfer for easy starting and protection of first thread
- Precision threads for easy running-up and tight joints

To make fittings the safest, strongest link in your piping system . . . choose from the wide Grinnell line. Available from your local Grinnell Distributor or a Grinnell Warehouse.

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

Years Ahead in Advance Engineering Design!

usAIRco GAS FIRED UNIT HEATERS

Controlled Even Temperatures on Heat Exchanger Surfaces Guarantees Longer Life and Better Performance

The unique design of the usAIRco Gas Fired Heaters eliminates both hot and cold spots on the heat exchanger surface. Instead of the conventional combustion box, each tube is designed as its own individual combustion chamber and is individually fired.

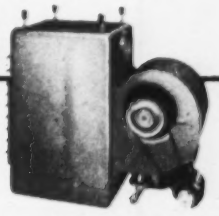
Diagram shows intake of air at the bottom of each tube. By drawing cool air continuously up interior wall of the tube, overheating at the bottom is avoided. Steel baffles at the top of the tube restrict rapid escape of hot gases, insuring high thermal efficiency and preventing cooling at the top of the heat exchanger. As a result, tubes are heated uniformly, and fairly even temperatures are maintained, removing the hazards of burnouts or rustouts, due to overheating or underheating.

FOR USE WITH NATURAL, MANUFACTURED, MIXED, LPG AND LP GAS AIR MIXTURES

SIZED TO FIT EVERY JOB
55,000 TO 500,000 BTU!

CHROME ALLOYED, INDESTRUCTIBLE CAST IRON BURNERS UNCONDITIONALLY GUARANTEED

PROPELLER FAN TYPE



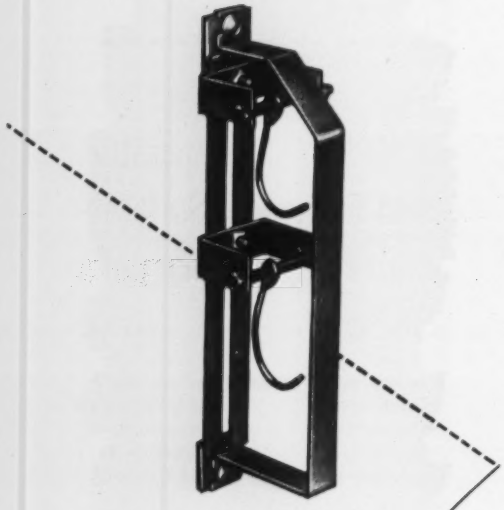
BLOWER TYPE
AGA APPROVED FOR USE WITH DUCTWORK

For descriptive literature write Dept. HP 953

UNITED STATES AIR CONDITIONING CORPORATION
MINNEAPOLIS 14, MINNESOTA

usAIRco

Bush heating installation...a pipe"



Bush FINNED pipe, that is! . . . at new Remington Rand Building in Hartford, Conn.

Contractors praise Bush finned pipe . . . say it's easiest to install of any type of finned radiation. Expansion hangers are the answer.

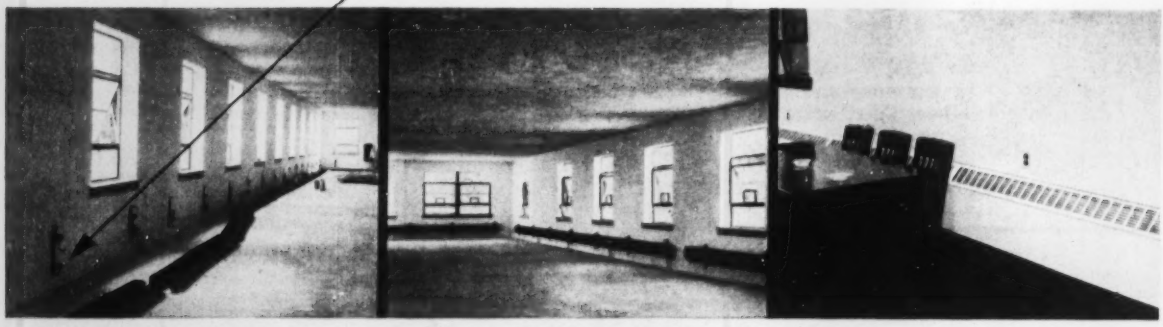
Bush expansion hangers . . . simple, efficient, practical. Attached to the wall with 2 bolts, these adjustable pipe hangers provide for a full 3" of horizontal expansion as well as 2" of pitching. Moreover, the complete assembly is designed to serve as support for the cover.

At Remington Rand's new office building in Hartford, the heat load for the 72' x 128' two story building is handled by two boilers — each with a capacity of 4480 sq. ft. of radiation. Continuous flow control — actuated by an indoor-outdoor thermometer — regulates the water temperature.

Bush type W finned radiation (4" x 4" on 2" pipe) has been used throughout. Bush covers provide the finishing touch to a modern, easily installed commercial heating system.

Check with a Bush Engineer the next time you're on an institutional, commercial or industrial heating job . . . make your task a "pipe".

Write for free bulletins on Bush finned radiation and covers.



Architect: Frederick C. Teich; Hartford, Conn.
Contractor: Morris A. Florberg Co.; Hartford, Conn.
Engineers: Hurley and Capacefalo; Winstead, Conn.

BUSH MANUFACTURING COMPANY
WEST HARTFORD 10, CONNECTICUT

Heating Piping & Air Conditioning

Vol. 25 No. 9

SEPTEMBER 1953

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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grease eliminators make my kitchen safer! cleaner!

HERE'S WHAT THEY CAN DO FOR YOUR KITCHEN!

Far-Air Grease Eliminators trap grease before it builds up in ventilating ducts to create dangerous fire hazards. Your kitchen will have better ventilation and sanitation for increased customer goodwill and personnel comfort. Its appearance will be improved because Far-Air Grease Eliminators are available in a variety of finishes to match existing equipment.

Expensive periodic duct cleaning is virtually eliminated because Far-Air Grease filters are easy to clean – simply detach from frame and flush with hose or run through dishwasher.

HERE'S WHY FAR-AIR FILTERS ARE MORE EFFICIENT!

Far-Air's exclusive herringbone-crimp media construction provides more efficient grease elimination, 50% more ventilation and assures a longer service period between cleanings.

Farr Engineers are available to help you with your filtration problem, show you how FAR-AIR Grease Eliminators can make *your* kitchen safer and cleaner. Fill out handy coupon below, mail today!

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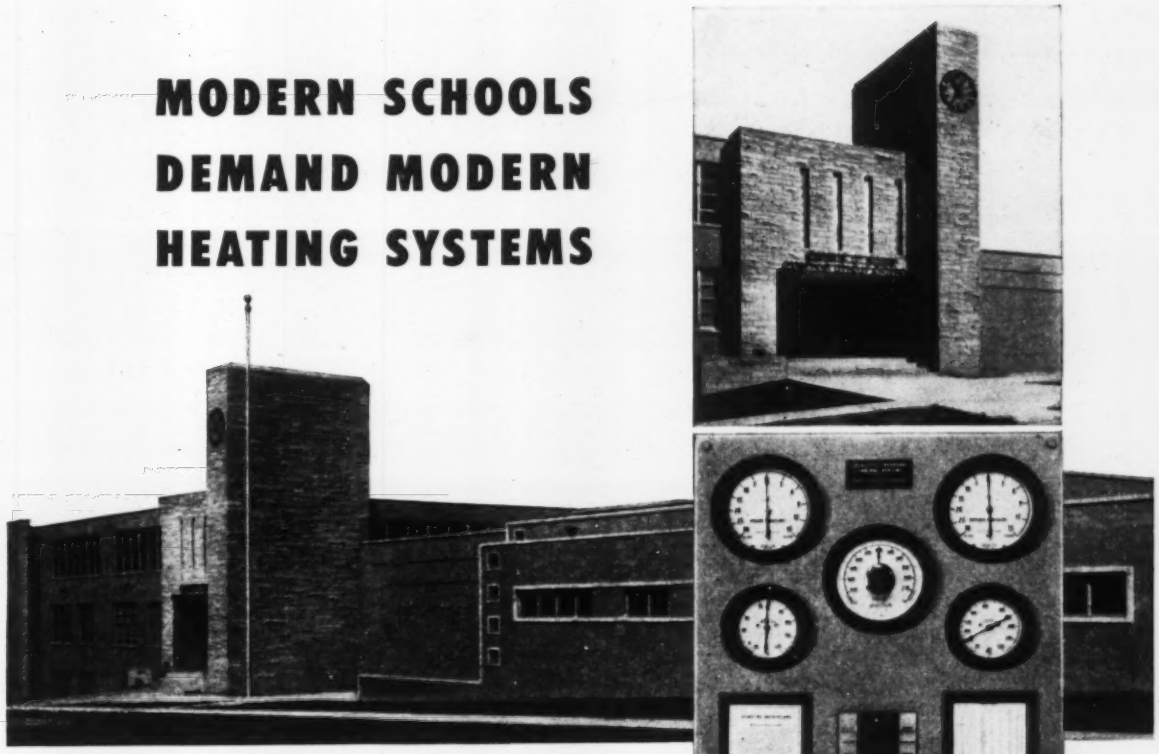

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ILLINOIS High Vacuum Control System

(Type "C" Generation Control)

Simplicity of operation is an outstanding feature. *The entire heating system is controlled at ONE POINT . . . the SELECTOR in the center of the control panel.*

Other Illinois heating systems include Type "A" Pneumatic and Type "R" Electric Zone Control as well as the standard vacuum and vapor systems.

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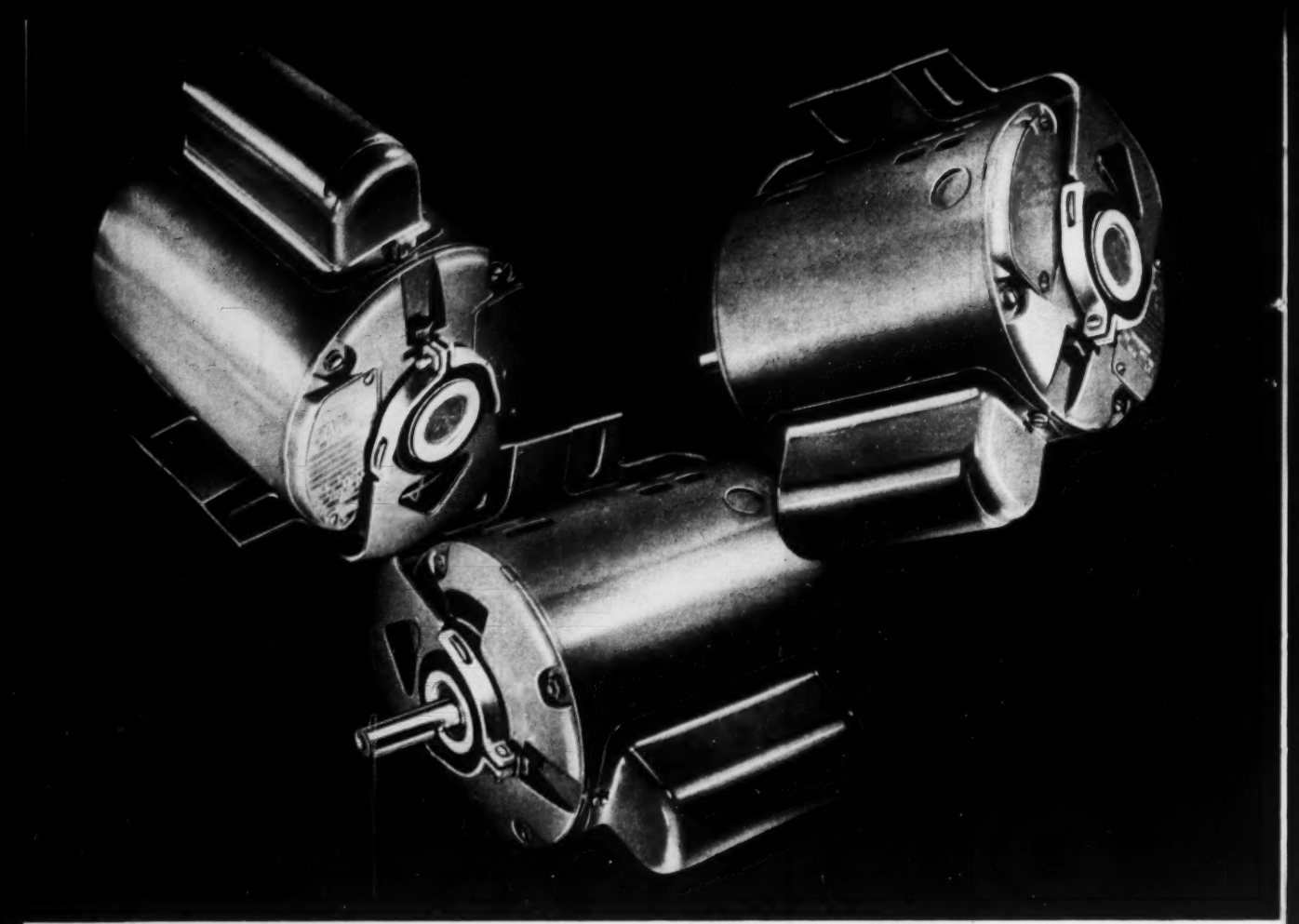
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8



ALL-ANGLE OPERATION FEATURES of G-E's new fhp motor permit lower cost installation on applications formerly requiring a more expensive motor. Extra large oil reservoir plus features shown at right, give you an all-position motor.

Mount this standard G-E

Lubrication system insures quiet all-angle operation

This new general purpose sleeve-bearing motor gives dependable performance regardless of mounting position. A unique thrust-bearing design permits moderate-thrust loads in any direction and a new lubrication system gives full retention and recirculation of oil.

Brand new "Mylar"* polyester film . . . a *modern* insulation . . . means longer motor life. Full NEMA performance with up to 50% less weight and 40% less size means maximum power in a minimum package . . . reducing your handling and shipping charges.

For more information call nearest G-E Apparatus Sales Office or write Section 702-3 for Bulletin GEA-5567, General Electric Company, Schenectady 5, N. Y.

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*DuPont trade-mark.

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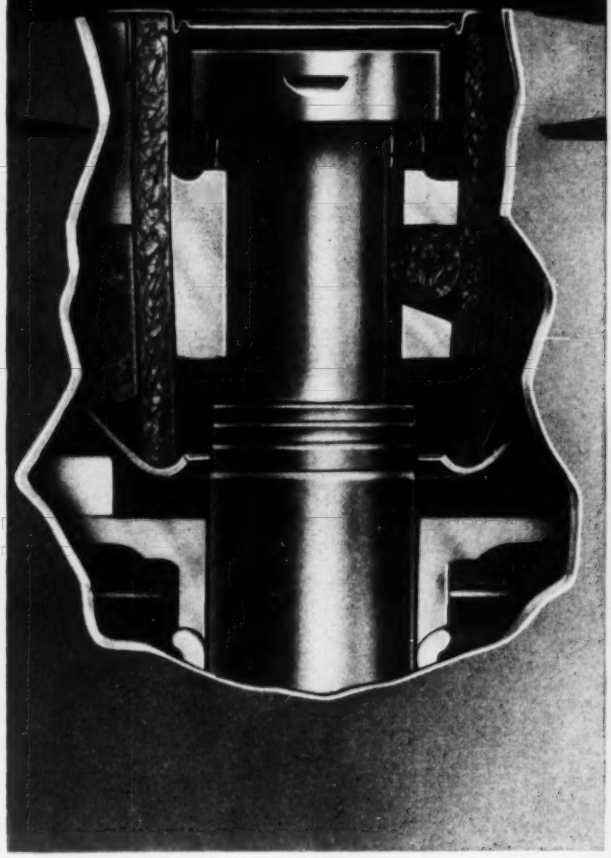
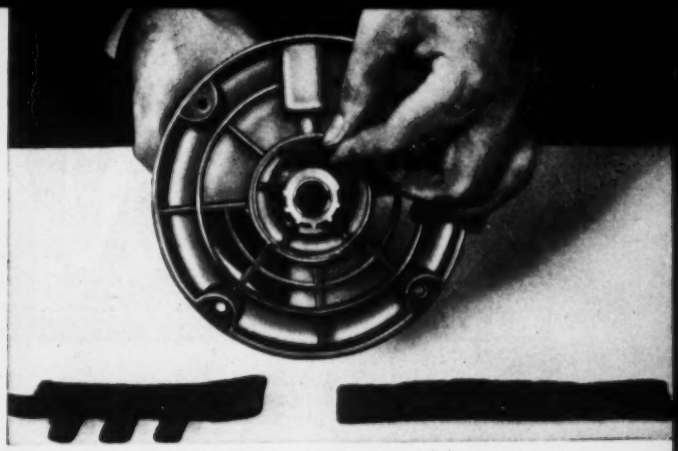
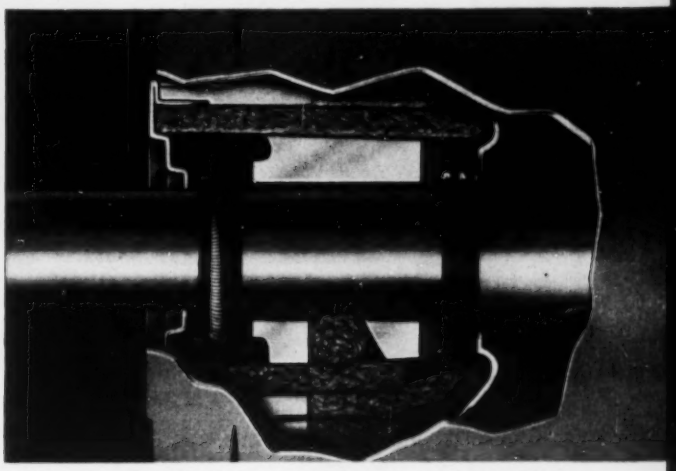
GENERAL ELECTRIC



LOCKED-IN THRUST WASHER ASSEMBLY makes it possible for this G-E motor to handle moderate-thrust loads in any direction.



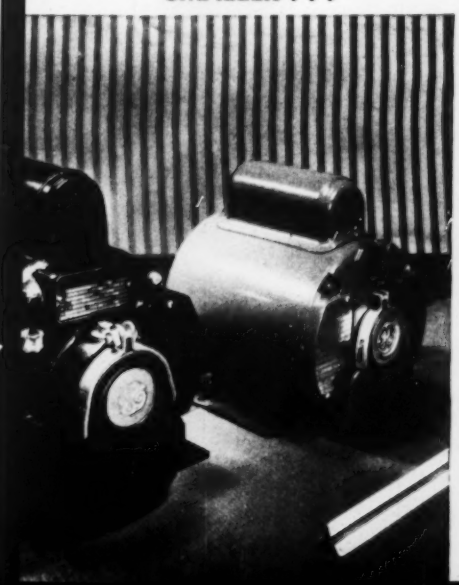
THREE LUBRICATING WICKS evenly lubricate the shaft by picking up the oil and retaining it for redistribution to the shaft.



SHAFT OIL THROWERS instantly return the oil to wicking while spring loaded thrower prevents loss of oil along the shaft.

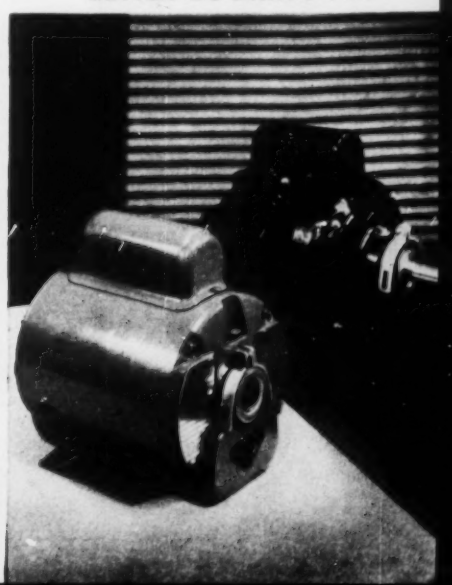
Fhp motor in any position

SMALLER . . .



LIGHTER . . .

BETTER LOOKING . . .



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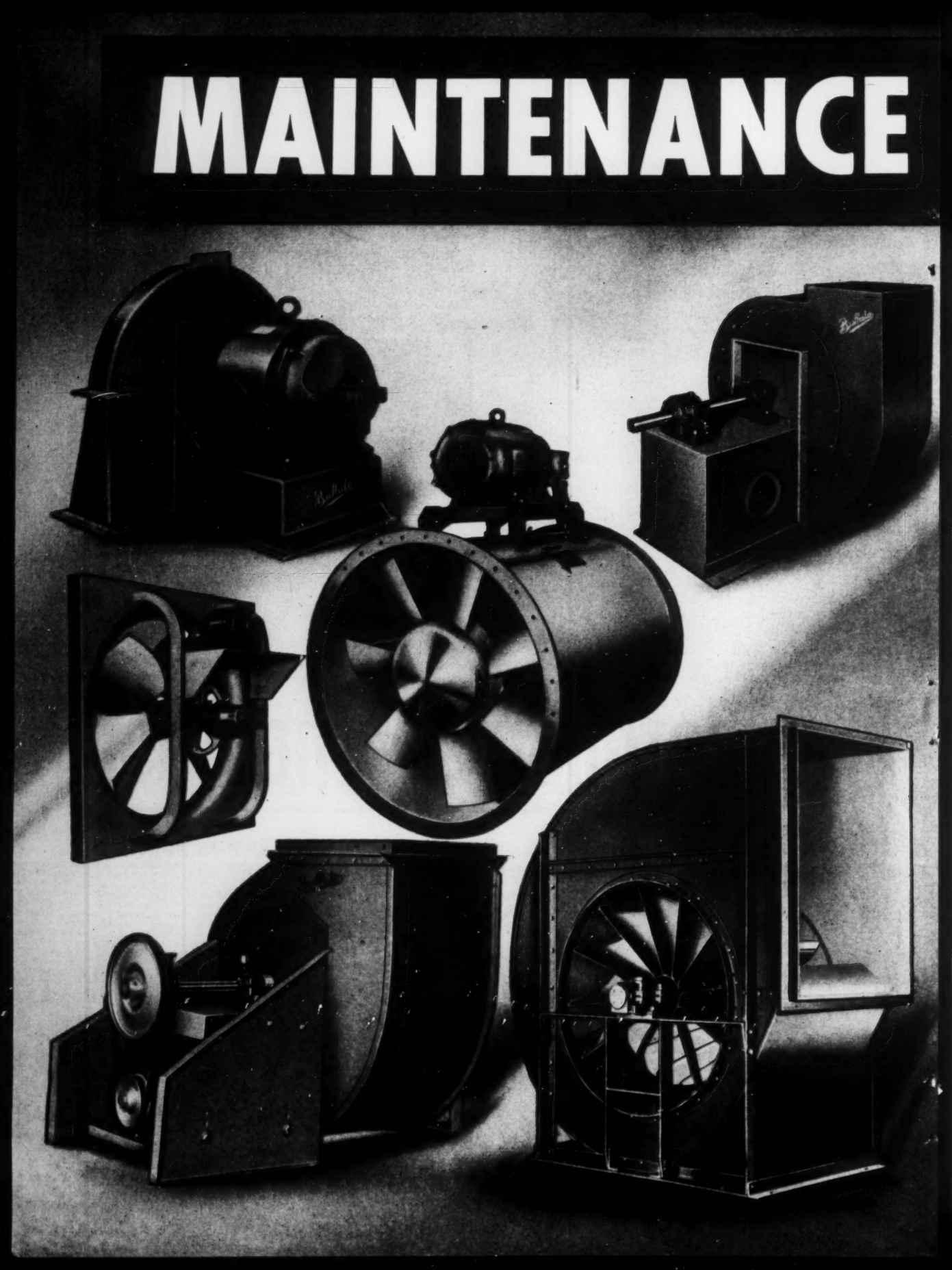
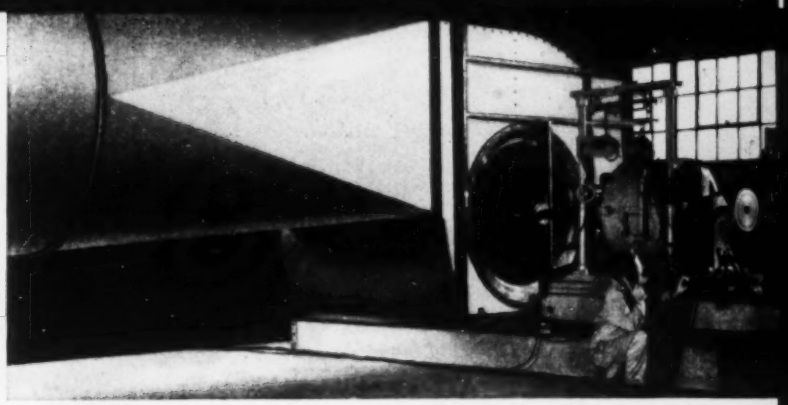


DIVIDENDS from PROPER FAN SELECTION



In the "Buffalo" Test Room, engineers put fans thru every conceivable performance test. Continual improvement — better performance — lower fan maintenance costs — are the results. In the above station, thrust, noise, and performance characteristics are checked.

If you keep records of maintenance costs, you'll already know that first cost can be of minor importance on some equipment.

On fans, for example, over a period of years, maintenance costs can be considerable. We believe, after seventy-six years' experience in air handling, that some of this excessive maintenance cost comes from improper selections of equipment.

"Buffalo" manufactures 20 lines of fans and blowers, for every service from residential kitchen ventilation to sub-zero airplane instrument testing — from 20 CFM to 600,000 CFM. We have, in our engineering files, almost every problem which AIR has been asked to solve.

We have the Engineering organization which produced, in 1914, the first edition of "Fan Engineering", ever since, the Bible of the air industry.

We do not hesitate to say, occasionally, "It cannot be done with present equipment."

Why not capitalize on this accumulated experience? Why not get the benefit of the "Q" Factor* that "Buffalo" builds into the fans, air cleaning and conditioning equipment, which our engineering sales representatives, in principal cities are ready to discuss with you? Their advice is impartial.

No obligation — and no regrets.

** — The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

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171 Mortimer Street Buffalo, New York

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

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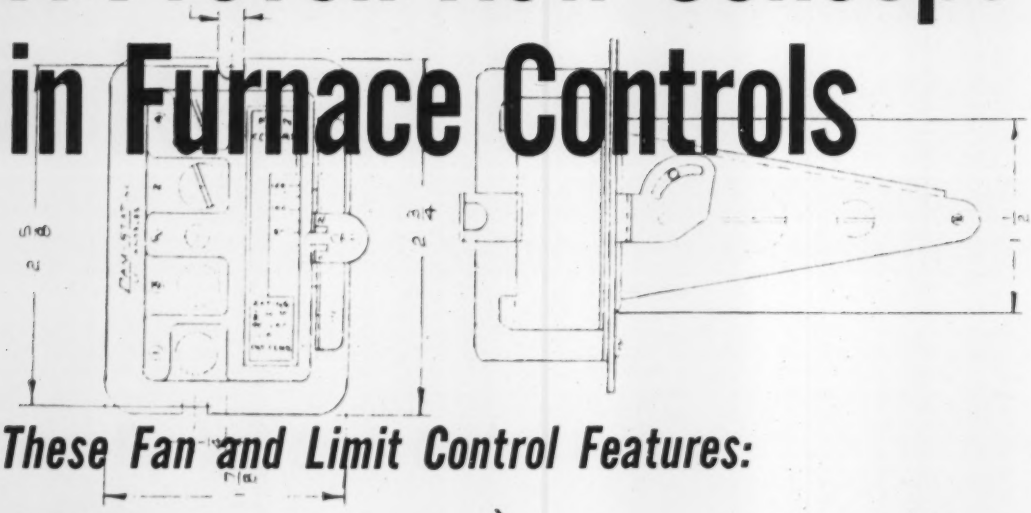

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- AVAILABLE FOR INTEGRAL OR PLENUM MOUNTINGS
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- EXTREME SENSITIVITY
- SNAP ACTION SWITCH—CLEAN MAKE & BREAK
- HIGHEST QUALITY
- LISTED BY UNDERWRITERS' LABORATORIES, INC.

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"UNI-FLO" ENGINEERED

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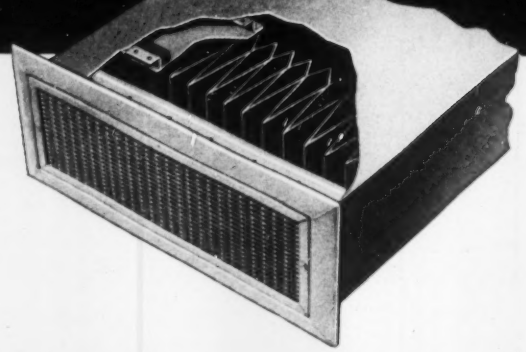
New Uni-Flo High Velocity System proves itself—

is extended to second and third floor addition of Allstate Insurance Company

Architects: Dunlap & Esgar. Consulting Engineer: William Goodman. Ventilating Contractor: The Haines Company. General Contractor: Kaiser-Ducett Company, all of Chicago.

Lobby of impressive Allstate Insurance Company building at Skokie, Illinois. Note Uni-Flo Sidewall Diffusers near ceiling which deliver low velocity air quietly for comfort of occupants.



Cutaway *of patented Uni-Flo Air Valve in short take-off from main duct. Valve reduces high velocity air to normal flow with whisper-quiet results. Call on Barber-Colman for accumulated experience and a group of new engineering developments which solve high velocity problems.*

Nothing succeeds like success! Trial of Barber-Colman's new high velocity system in the first floor of Allstate Insurance Company's new building led to adoption of the same system for the second and third floor addition now being built.

Pressed for height in the original building, the architects and engineers turned to the high velocity system as a means of saving space. Small size ducts were installed and furred into place, lining up with the window soffit. Velocity of 3000 fpm at the fan . . . with 3" static pressure in the supply plenum . . . called for use of Barber-Colman's unique Uni-Flo Air Valves in back of each outlet. The result — highly efficient air distribution at a remarkably low noise level — led to flat specifications of Barber-Colman equipment for the new addition.

One unique feature of the original installation was the use of Uni-Flo Air Valves to balance air quantities supplied to different zones. The contractor reports the innovation simplified balancing operations, thus saving on cost.

To be in the know on fast-growing high velocity systems . . . and their application to new or old buildings . . . call your nearby Barber-Colman field office for complete details. Or send coupon below for new booklet "High Velocity Air Distribution."

(Above) **Ductwork** before installation of partitions or metal lath ceilings. Complete job required 340 Air-Valves, 12 High Velocity Control Units, 207 Sidewall Diffusers and Return Grilles, 10 Air-turns. (Right) **Air-Valve** and Diffuser go into place. Valve is adjusted quickly and easily with key through face of Uni-Flo Double Deflection Sidewall Diffuser.

(Above) **Meeting room** is free from disturbing air-noise, yet has ample, efficiently diffused air supply for participants in group discussions. (Below) **In addressograph room,** normal air flow is distributed effectively through attractive Uni-Flo Ceiling Diffusers (individually adjustable).

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EMMET 58

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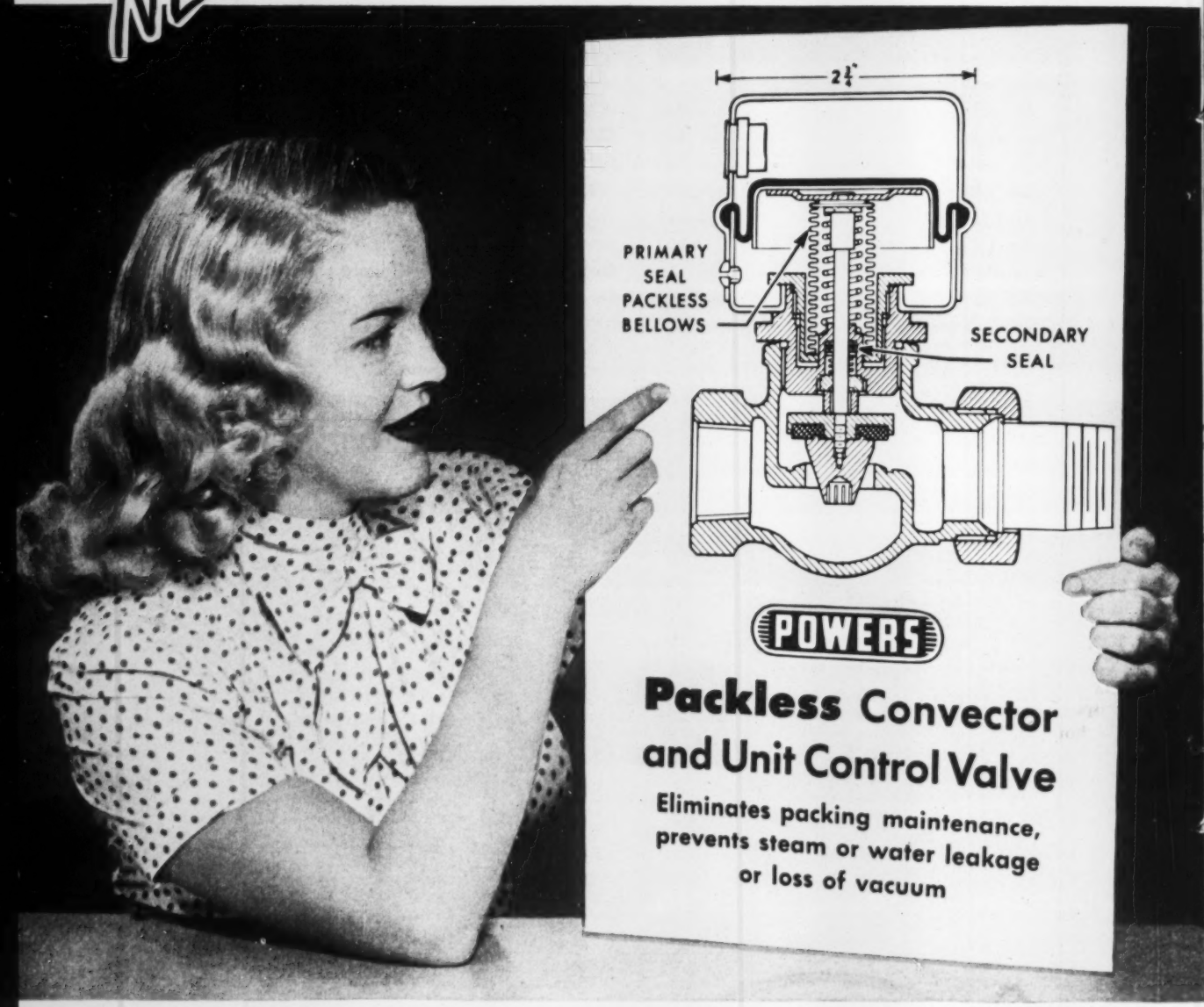
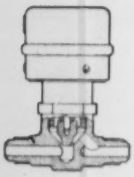
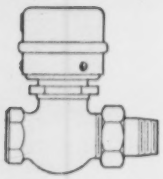
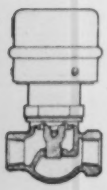
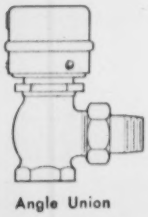

2¼"
PRIMARY SEAL PACKLESS BELLOWS
SECONDARY SEAL
POWERS
Packless Convector and Unit Control Valve
Eliminates packing maintenance, prevents steam or water leakage or loss of vacuum


Flared Ends


Straightway Union

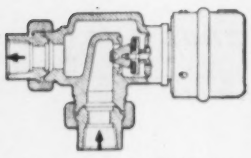

Screwed Ends


Angle Union

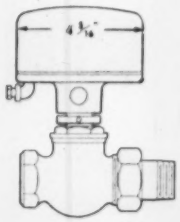
POWERS-PACKLESS-VALVES

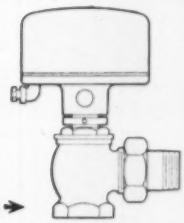
Never require re-packing.

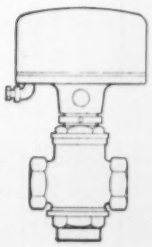
Real Economy in Maintenance year after year


Reverse Flow Double Union

Available in various types and sizes for control of convectors, unit ventilators, unit air conditioners and radiators.


Straightway Union


Angle Union


3-Way Screwed Ends

Automatic Temperature Control
Now Include

POWERS-**PACKLESS**-VALVES

For Controlling Convectors, Unit Ventilators, Unit Air Conditioners and Radiators.

Now, at NO Extra Cost – users of Powers pneumatic control systems will get the additional benefits of still lower operating and maintenance costs – insured by Powers packless valves.

Duo-seal Construction Gives Them Superior Performance. Bronze packless bellows is the Primary Seal which eliminates packing maintenance – packing friction – steam and water leakage or loss of vacuum. Secondary Seal permits servicing of valve top without draining the water system or shutting off the steam supply.

Typical Specifications for POWERS-Packless-Pneumatic Control Valves

Control valves for convectors, radiators and unit ventilators shall be packless type with bronze packless bellows to eliminate steam and water leakage or loss of vacuum. This packless bellows shall be located so that it is not subject to corrosive action of the steam or water. A spring-loaded secondary seal shall be provided to permit convenient inspection or servicing of valve top without draining the water system or shutting down the steam supply.

Valve sizes shall be determined by control manufacturer for capacities specified. Type of valve body and valve top to be used shall be as required to best satisfy the application.

Valves shall be equipped with phosphor bronze bellows or Neoprene diaphragms of sufficient size to close off against specified line pressures. Diaphragms shall be replaceable. Valves shall be equipped with characterized throttling plugs to insure a measured flow of steam or water in direct relationship to the demand of the controlling thermostat.

POWERS CONTROL

THE POWERS REGULATOR CO.

Skokie, Ill. • Offices in Over 50 Cities in the U. S. A., Canada and Mexico
See Your Phone Book

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

Banish PACKING Maintenance

No Loss of Vacuum

... leakage of air reduces efficiency of heating system and increases corrosion in return lines

No Steam or Water Leakage

(b18)

Only a Few of **POWERS** Complete Line of Modern Control Valves for Regulating Heating and Air Conditioning Systems

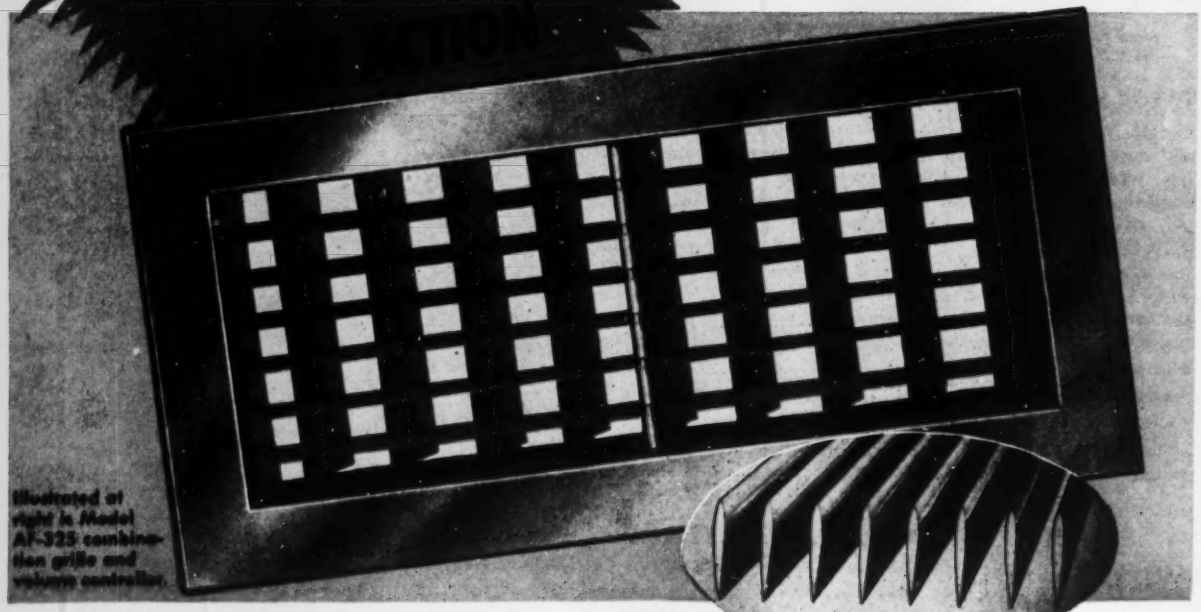
IMPORTANT MESSAGE

...See for Yourself

COMPARE

To everyone responsible for the specification and installation of air conditioning outlets.

IF YOU ARE GETTING LESS THAN EVERY SINGLE ONE OF THESE FEATURES IN EVERY OUTLET YOU USE...*YOU ARE NOT GETTING YOUR MONEY'S WORTH.*



Illustrated at right is Model AF-325 combination grille and volume controller.

These important comparison facts explain why TITUS AIRFOIL OUTLETS look better, perform better, are better constructed, *OUTMODE* all other outlets.

They are built *above* and *beyond* average demand, yet cost is kept at standard prices.

Illustrated above cutaway view showing solid section, streamlined Airfoil Louvers.

1 75% TO 85% FREE AREA .... Greater than ordinary grilles.

2 EASY 4-WAY ADJUSTMENT .. Not necessary to remove or invert grille to get complete 4-way adjustment.

3 INSTALLS IN 1/10 ORDINARY TIME ..... Workmen need not remove grilles. Dirty hands never touch grille or wall to leave dirty, expensive smudges.

ORDER *A Sample* TITUS GRILLE

IT FEATURE FOR FEATURE WITH EVERY OTHER GRILLE ON THE MARKET TODAY

4 SOLID SECTION AIRFOIL LOUVERS..... Smooth as glass. Streamlined. Eliminate turbulence. Control air properly.

5 ONE-PIECE FRAME..... Adds new beauty to any installation. No unsightly corner cracks or corner patches.

6 EXTRA STRENGTH..... Without clumsy bulk. Easy to carry. Easy to handle.

7 CLEAN WITHOUT REMOVING GRILLE... Removable core not necessary. Made available, however, if desired.

8 LOW NOISE LEVEL..... Streamlined louvers handle air with near perfect performance. Hold noise level to absolute minimum.

Before you start your next job, order a sample grille. Prove to yourself by *True* comparison . . . holding the grille in your hands . . . that you get better grille construction, more beauty, and consequent better grille performance from TITUS OUTLETS. ORDER TODAY.

*SALES OFFICES IN ALL PRINCIPAL CITIES

FREE 1953 CATALOG

MAIL COUPON NOW

TITUS MANUFACTURING CORP., WATERLOO, IOWA

CHECK TYPE OF GRILLE ON WHICH SPECIAL INFORMATION IS DESIRED.

- ☐ Air Conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Door ventilators
- ☐ Special made-to-order grilles
- ☐ Send complete New 1953 Catalog

NAME _____

ADDRESS _____

CITY _____ STATE _____

For complete satisfaction, install POWELL VALVES

To be completely satisfactory, a valve must function perfectly, give maximum length of service and require minimum maintenance. To do this it has to be exactly right—in design and materials—for all the conditions under which it must operate. And because Powell makes just such a valve for every service in modern industry, Powell Valves always give complete satisfaction.

The Wm. Powell Co., Cincinnati 22, Ohio

Fig. 1503—150-pound Cast Steel O. S. & Y. Gate Valve. Flanged ends and tapered solid wedge.

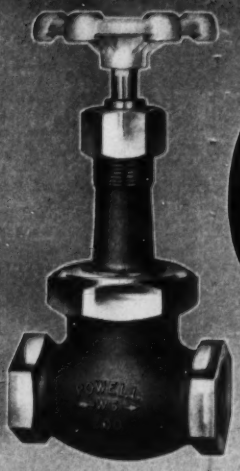


Fig. 2608—200-pound Bronze Globe Throttling Valve. A Powell design that permits full flow through the seat when wide open. Has special bronze stem and stainless steel seat and disc.

Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve with regrindable, renewable bronze seat and disc.

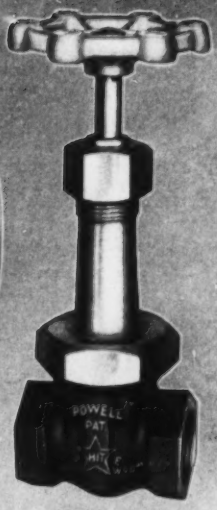
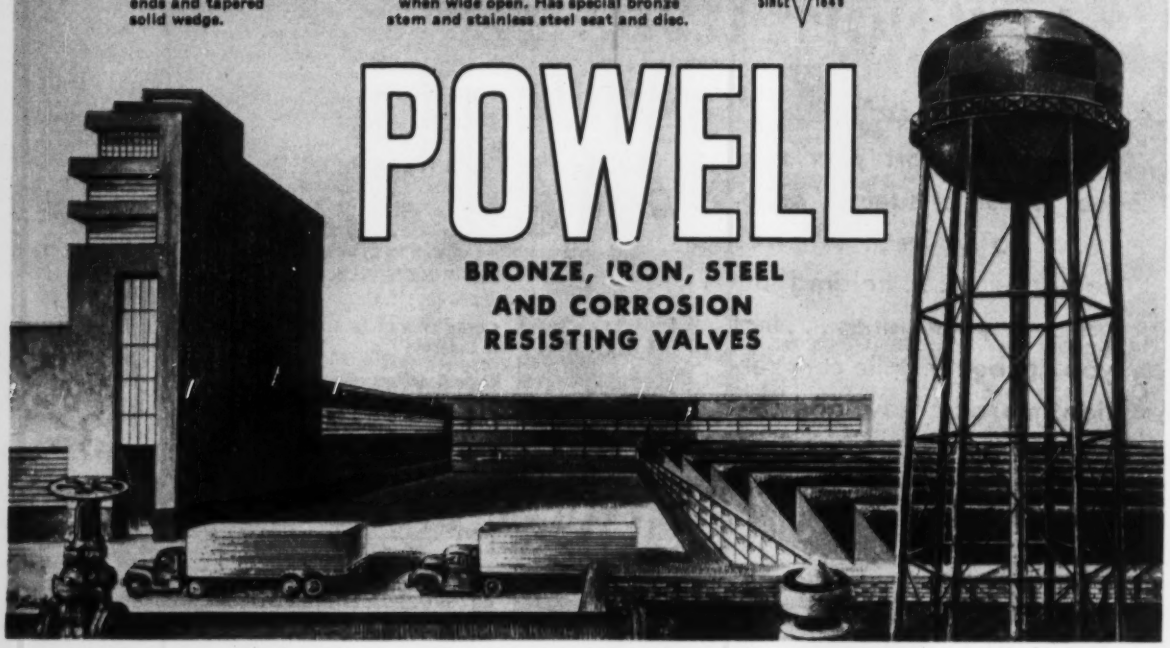


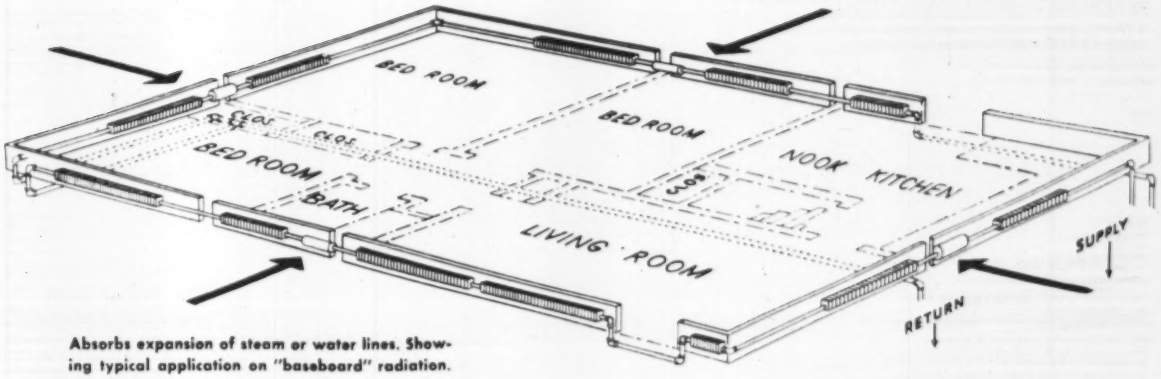
Fig. 375 — 200-pound Bronze Gate Valve with union bonnet and renewable wear-resisting Powellium nickel-bronze disc.

DEPENDABLE VALVES SINCE 1846

POWELL

BRONZE, IRON, STEEL AND CORROSION RESISTING VALVES

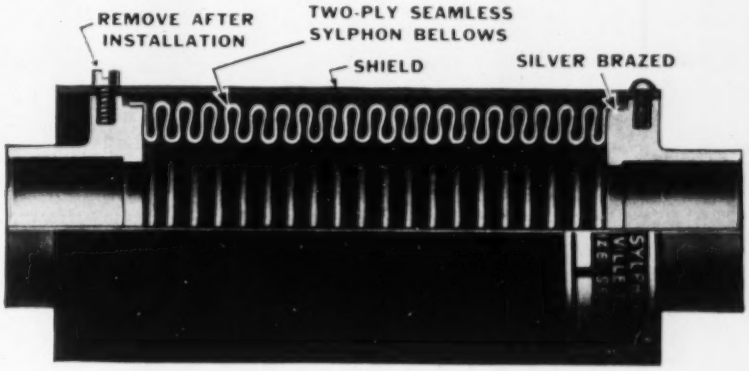




Absorbs expansion of steam or water lines. Showing typical application on "baseboard" radiation.

Sylphon Packless Expansion Joint No. 96066

for "baseboard" radiation, finned tube convectors, horizontal supply lines, etc.



Simplifies . . . saves money . . . on heating installations!

● Here's a simple, compact means for absorbing expansion of hot water or steam lines feeding wall, fin or "baseboard" radiation or similar long-run heating surface.

This Sylphon Packless Expansion Joint No. 96066 has a minimum number of parts for simplicity of operation. It is completely assembled at the factory, for ease of installation—either horizontally or vertically. Can be easily removed from the lines.

All parts made of brass, except the two-ply seamless Sylphon bellows which takes care of any movement of the pipe line. Bellows is made of phosphor deoxidized copper—replaces packing commonly used in many expansion joints—prevents any leakage.

Small and neat, it is sturdily built for long, trouble-free service. Low cost. For complete information, sizes, pressure limits, etc., write for Catalog RH-E.

FIRST WITH BELLOWS

Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
DIVISION

ROBERTSHAW-FULTON CONTROLS CO. KNOXVILLE 1, TENN.

Canadian Representatives, Darling Brothers, Montreal

Several thermostats, strategically placed, are required to give proper temperature control in the Oregonian's large combination office and lobby area. Honeywell Customized Temperature Control keeps the comfort level just right in all areas, all the time.

Story of Honeywell Customized Temperature Control helps you

Learn about your business– from a publishing plant

Why a customized temperature control system is becoming a "must" for all types of buildings

How do you provide for real comfort if your building is large, has huge areas of glass and is exposed to the elements in all four directions?

And especially, how do you answer this question when your building accommodates such a variety of rooms as offices, press rooms, composing rooms?

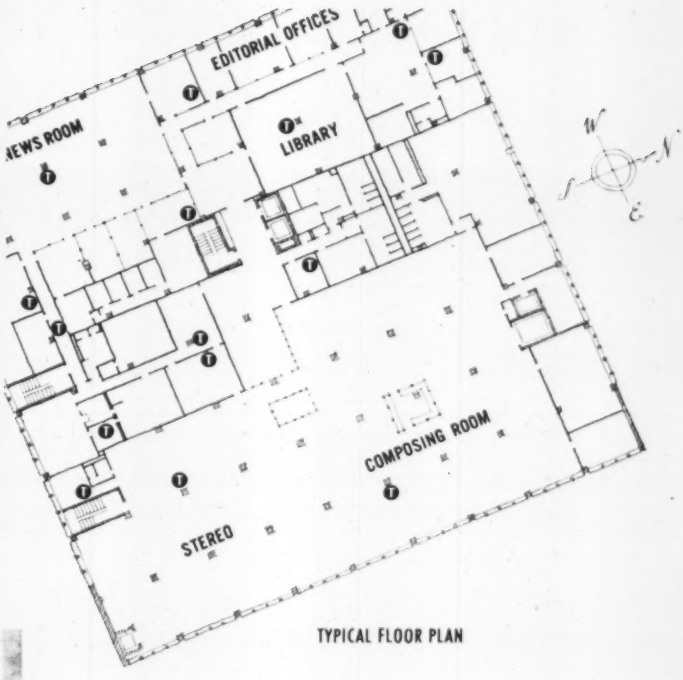
For that matter, how can you be certain temperature control equipment will stand up under 24-hour operation and give the dependable service you can't afford to get along without?

With modification, these major questions which Oregonian officials in Portland, Oregon, and their professional advisers had to answer, can be applied to the businesses of your clients. The answer can be stated in five words: Install Honeywell Customized Temperature Control. This is the answer officials of the Oregonian Publishing Company have found eminently satisfactory. It is the answer for your clients, too.

Key reason why this is so is found in the word *customized*. This means that whatever the control requirements, Honeywell Customized Temperature Control *designed to meet the needs of the building* is your solution. This applies to heating and cooling, ventilation and humidity control.

The customized installation in the case of the Oregonian included careful selection and strategic placement of thermostats as indicated on the floor plan.

Specific problems solved by the Honeywell Customized Temperature Control installation are brought out in the photo captions.



TYPICAL FLOOR PLAN

For comfortable, even temperature in new or existing buildings—of any size—use Honeywell Customized Temperature Control

Whether it's an office, airport, hospital, apartment, church, school, factory, store, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate"—and save fuel besides.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

Architect of the Oregonian Building was Pietro Belluschi. Mechanical Engineering was by J. Donald Kroeker and Associates.

M. J. Frey, publisher of the Oregonian, says:

"Because of our complex comfort problem we have 110 separate temperature controls in the building. All of these are Honeywell controls. And they all perform in a completely satisfactory manner."

Several thermostats are necessary in the press room to compensate for heat from the presses themselves—and for solar heat entering through the big windows. Press room employee comfort is also well-guarded by Honeywell Customized Temperature Control.

The comfort problem in the editorial room is quite different. Workers at desks are much less active than press room employees, require a somewhat higher temperature. Loss (or intake) of heat from row of large windows must also be compensated for. But with Honeywell Customized Temperature Control on the job, these problems are easily met—and it's comfortable all the time.

MINNEAPOLIS **Honeywell**

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-9-177 Minneapolis 8, Minnesota

Gentlemen:
I'm interested in learning more about Honeywell Customized Temperature Control.

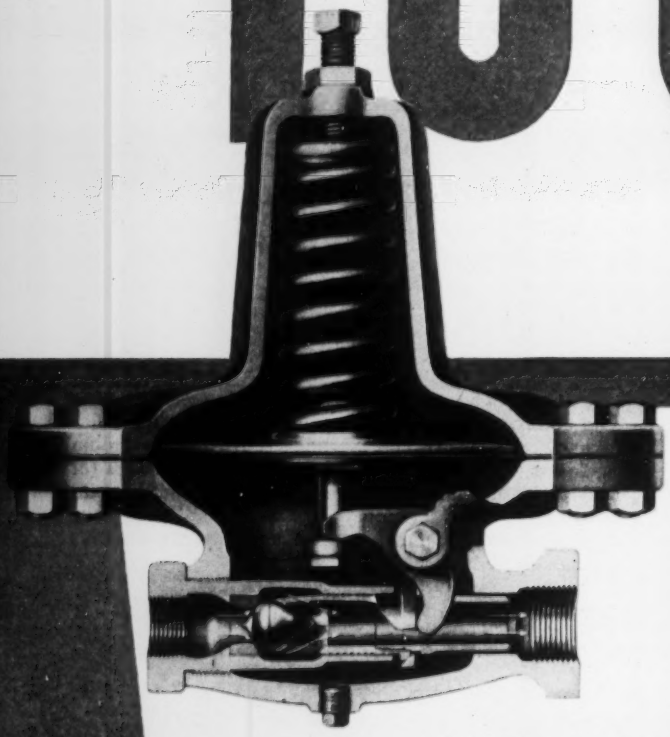
Name .....

Firm Name .....

Address .....

City ..... *Zone* ..... *State* .....

TYPE 1000 VALVE



Any product of quality should be dependable when *ordinary* products fail. Sudden pressure fluctuations, dirt, scale and viscous matter prove "fatal" to ordinary pressure reducing valves.

The CASH STANDARD TYPE 1000 VALVE however, is designed to operate with complete dependability under the most difficult and unusual circumstances. Many of these units have been in service over 10 years and have never been taken "out of the line."

Truly an *EXTRAORDINARY* achievement of quality and design excellence.

INSTALL CASH STANDARD "TYPE 1000" VALVES

CASH STANDARD **DECATUR, ILLINOIS**

A. W. CASH COMPANY

Putting Air to Work For Bell Telephone: delicate relays and switches thrive on dirt-free air.

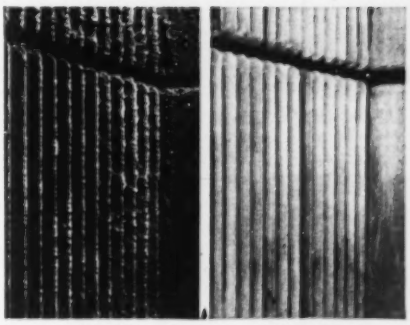
Electronic Air Cleaning

IMPROVES YOUR TELEPHONE SERVICE

Every time you dial a number, over 900 tiny contacts are set in motion. A speck of dirt in any of them may delay your call, so offices must be kept clean. That's why Bell gives their equipment the "kid glove" treatment.

In many Bell System exchanges in centers of heavy industry, Westinghouse PRECIPITRON®, the electronic air cleaner, keeps air at its highest purity. It traps the fine particles of dust and dirt which pass right through conventional filters. Result: better service for you; reduced maintenance costs for the exchange.

Chances are airborne dirt is costing *you* money. For example, in cleaning expense, in rejects, in damage to equipment or processes. For help on problems of air cleaning, air handling or air conditioning call your Westinghouse-Sturtevant office. Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.



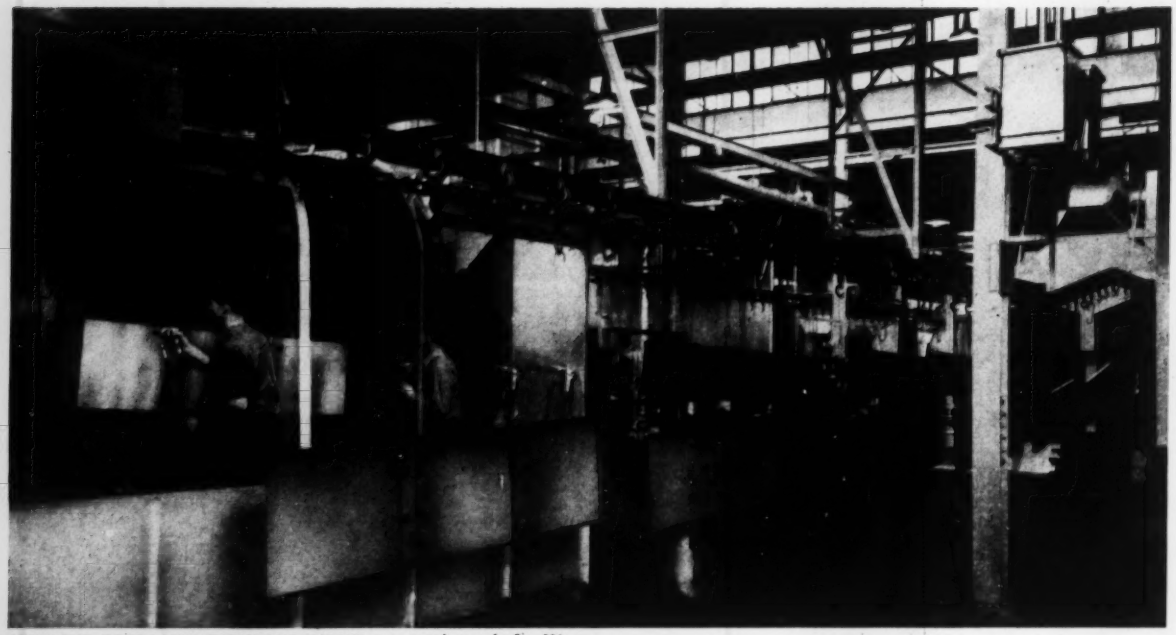
Dirty Plates **Clean Plates**

PRECIPITRON is the most efficient commercial air cleaner available. All dirt particles receive an electric charge, are attracted and cling to collector plates of opposite polarity. Periodically they are flushed down the drain.

Photo above left shows amount of dirt collected on PRECIPITRON plates after 2½ weeks. Photo at right shows plates after cleaning.

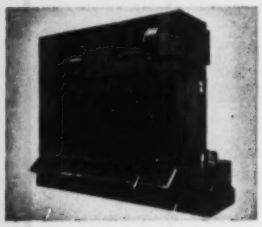
WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE ... IF IT'S Westinghouse J-80319



SPRAYING CORROSION-RESISTANT ENAMEL on metal panels for Worthington evaporative condensers and air conditioners. This chlorinated rubber base enamel, selected by Worthington after rigorous tests, resists chipping and long exposure to salt fog, acids, alkalis, ultra-violet light, and high and low temperatures.

FAN HOUSINGS ARE LOADED on conveyor which carries them through Worthington special 5-stage washing process. This washing, which includes sprays of Bonderite and mild chromic acid solution, prepares the equipment for the corrosion-resistant enamel.



YEARS OF TROUBLE-FREE SERVICE are assured with this Worthington evaporative condenser. The corrosion-resistant finish, rugged construction, large diameter hollow fan shaft and self-aligning ball bearings are some of the features that make this unit the finest available. You can get a Worthington evaporative condenser in any one of 18 sizes, in capacities of 10 to 150 tons.

Rustproof finish adds years to life of air conditioning equipment

For years, corrosion has presented a real problem in air conditioning and refrigeration equipment. Brine spray, water, fumes—all caused metal equipment to corrode. To combat this, Worthington engineers developed the bonderized two-coat baked chlorinated rubber enamel finish now used on all Worthington air conditioning and refrigeration units.

This finish, the result of years of testing and research, completely protects the metal against corrosion and preserves the original appearance of the equipment. Rigorous tests have shown that this finish will last at least three to four times longer than the best hot-dipped galvanizing coating.

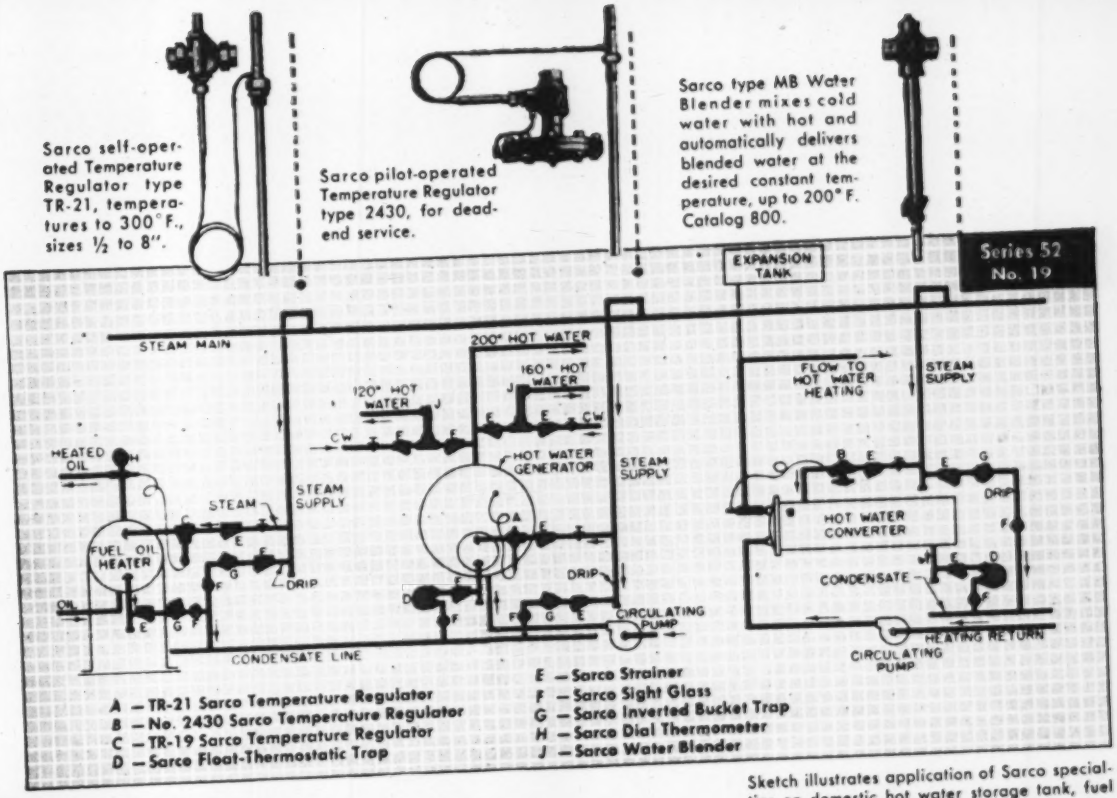
Advances in construction and design like this are standard practice with Worthington, a leader in air conditioning and refrigeration for over half a century. From giant industrial refrigeration systems down to the air-conditioner for a baby's nursery, Worthington can handle any job, and provide exactly the right equipment. So when you think of air conditioning or refrigeration—think of Worthington.

For more information, get in touch with your nearest Worthington distributor. Or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.40, Holyoke, Mass.

A.3.40

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME


Sarco self-operated Temperature Regulator type TR-21, temperatures to 300°F., sizes ½ to 8".
Sarco pilot-operated Temperature Regulator type 2430, for dead-end service.
Sarco type MB Water Blender mixes cold water with hot and automatically delivers blended water at the desired constant temperature, up to 200°F. Catalog 800.
Series 52 No. 19
EXPANSION TANK
STEAM MAIN
200° HOT WATER
160° HOT WATER
120° HOT WATER
HOT WATER GENERATOR
STEAM SUPPLY
FLOW TO HOT WATER HEATING
HEATED OIL
STEAM
FUEL OIL HEATER
DRIP
HOT WATER CONVERTER
CONDENSATE
CIRCULATING PUMP
CONDENSATE LINE
HEATING RETURN
A — TR-21 Sarco Temperature Regulator
B — No. 2430 Sarco Temperature Regulator
C — TR-19 Sarco Temperature Regulator
D — Sarco Float-Thermostatic Trap
E — Sarco Strainer
F — Sarco Sight Glass
G — Sarco Inverted Bucket Trap
H — Sarco Dial Thermometer
J — Sarco Water Blender

Sketch illustrates application of Sarco specialties on domestic hot water storage tank, fuel oil heater and converter for space heating.

DEPENDABLE water heater control

5 POINTS TO CHECK! For hot water always at the desired temperature—never too hot or too cold—without attention,

insist on SARCO Temperature Regulators and Water Blenders

1. *Trouble-free design*—at the right are a few of the many Sarco temperature regulator installations which give years of maintenance-free operation.
2. *Self-operated* and self-contained—do not depend upon outside sources of power, such as compressed air, electricity or water.
3. *Full modulating action*—valve operated by thermostatic system *filled with oil*—which expands *uniformly* with temperature. NO dependence upon critical vaporizing temperatures of volatile fluids.
4. *Wide range of adjustment* above and below factory setting. Your choice is not limited to "standard ranges."
5. *No troublesome stuffing boxes*—Sarco *packless* seals used for valve stems. NO leaking, sticking, or repacking.

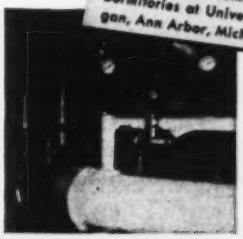
Before you buy . . . compare with SARCO

Write for Catalog 600-14 for full information on various types of Sarco Temperature Regulators and Water Blenders. Ask for a questionnaire on which you can report your exact requirements. Sarco Company, Inc., Empire State Bldg., New York 1, N.Y. Branches in principal cities. Sarco Canada Ltd., Toronto 8, Ontario.

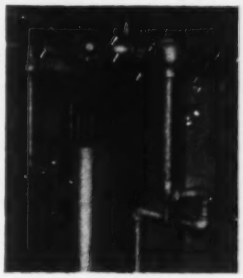
SARCO saves steam

a sarco temperature control for every job

Sarco type TR-21 self-operated temperature regulators on service water storage tanks from twin heaters as installed some years ago in dormitories at University of Michigan, Ann Arbor, Michigan.



Sarco type 2430 temperature regulator on instantaneous water heater supplying water at various constant temperatures to experimental extruding machines at Western Electric Company's vast wire and cable plant at Point Breeze, Md. In use since 1948.



2½" Sarco Water Blender type MB as installed some years ago in the dormitories of University of Michigan to reduce washroom and shower water temperatures from 180°F., to a constant 120°F.

405

Oh, I see

OIC VALVES at work in the power plant at Ford Motor Company.

THE CLEVELAND PLANT of the Ford Motor Company, showing the engine plant, foundry and power plant.

...they're using our valves at FORD

Ford cars are an example of true manufacturing efficiency. Ford buys only that equipment which can be relied upon to maintain or increase such efficiency.

OIC's Long Line of valves meets Ford's exacting specifications. They're used here on basic facilities and main piping systems for water, steam and air. Because they're precisely engineered for long, trouble-free service, OIC Valves can help you achieve maximum efficiency in control of flow. Write for catalog information or engineering assistance in selecting and applying valves.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1887

VALVES | **FORGED & CAST STEEL, IRON & BRONZE, LUBRICATED PLUG VALVES**

WHY IT PAYS TO BUY STEEL FROM WAREHOUSE

You don't need to invest in expensive cutting equipment !

WHEN YOU BUY STEEL FROM WAREHOUSE YOU GET:

- LOWER INVENTORY COSTS
- LOWER SPACE COSTS
- LOWER TIME COSTS
- LOWER CAPITAL INVESTMENT
- FASTER PRODUCTION
- FEWER INVENTORY LOSSES

TYING up money in large, expensive steel-cutting machinery is something you can avoid, if you wish. Yet you can have your cutting done on the most modern equipment available. When you order your steel from U.S. Steel Supply, specify just how you want it cut. We will meet these specifications exactly. For example, our flame cutting equipment will follow the most complicated patterns without error and turn out finished shapes precisely as you want them. Your U.S. Steel Supply salesman will give you complete information about our cutting services.

U. S. STEEL SUPPLY

DIVISION

General Office
208 So. La Salle St., Chicago 4, Ill.

Warehouses and Sales Offices Coast to Coast

UNITED STATES STEEL

When you buy steam, hot water

STEAM OR HOT WATER UNITS

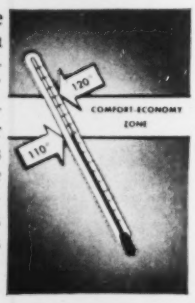
—featuring a great, new line of Modine Verticals

LOOK 'EM

Great, new, improved Modine Vertical Unit Heaters are quieter, lighter, have higher output. Modine also offers a full line of horizontal delivery units.

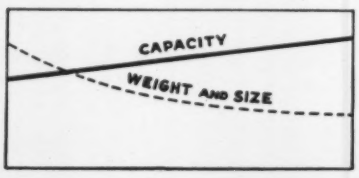
LOOK FOR CORRECT DISCHARGE TEMPERATURES

New Modine Verticals give you discharge air temperatures of 110° to 120° F. correctly related to air velocities. This combination is the key to perfect heating comfort plus lower fuel costs for you.



LOOK FOR GREATER CAPACITY — LIGHTER WEIGHT — LOWER INSTALLED COST

New Modine Verticals provide greater heating capacity because of new high efficiency condenser design. Yet, these *stepped-up* Modines weigh far less, are easier to handle, cost less to install.



LOOK FOR THE BROADER LINE

You have more sizes to choose from when you choose new Modine Verticals. This means it is easier for you to meet specific temperature, air delivery, and location requirements. *But see for yourself!* Call the Modine representative listed in your phone book or write for Bulletin 153 on Modine Steam and Hot Water Unit Heaters today.

or gas-fired unit heaters....

ALL OVER!

GAS-FIRED UNITS

— Only Modine has stainless steel heat exchangers *and* burners

Modine Gas-Fired Unit Heaters are built in a full line of popular sizes. All are A.G.A.-approved for natural, mixed, manufactured, L.P. and L.P.-air gases.

LOOK FOR EASY INSTALLATION

Advanced stainless design makes Modines 50% lighter in weight — more compact — than the average of seven other leading makes. Installation is faster, easier — no need for special structural supports. On one job, it cost the heating contractor $600 less to install 66 Modines than conventional units — savings he passed on to the owner.

LOOK FOR TOP PERFORMANCE

Not only do Modine units resist corrosion—all tubes heat uniformly because they're individually fired. Burners have elongated ports with four times the free area of ordinary drilled ports for maximum combustion efficiency. Remember: with Modines you are *sure* of getting full rated capacity.

LOOK FOR ALL-AROUND VALUE

As the leader in the development and application of steam and hot water unit heaters for more than 25 years, Modine brings unequalled experience to gas unit heating problems. It is the only manufacturer to publish heat throw data for gas-fired units. For facts, ask for Bulletin 653. Modine Mfg. Co., 1509 DeKoven Avenue, Racine, Wisconsin.

U-1203

Modine UNIT HEATERS

NEW

HEAT SAVING EFFICIENCY

with Mundet 85% Magnesia

Send for Complete New Catalog

Mundet district offices are conveniently located coast-to-coast.

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339-41 Elizabeth Street, N.E.

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In Canada:
Mundet Cork & Insulation, Ltd.
35 Booth Avenue, Toronto

Now available in pipe covering and block insulation, Mundet Custom-Molded 85% Magnesia permits new heat-saving efficiency.

You benefit from these advantages when you use Mundet 85% Magnesia Insulation.

- ***Easier to Apply***
  It cuts easily and cleanly, even without canvas support. No chipping, crumbling or "powdering." Blocks score cleanly.
- ***Lighter Weight***
  Only 11 lbs. per cubic foot density. Even larger sizes and thicknesses are easy for one man to handle.
- ***Controlled Uniformity***
  Precision manufacture on the latest type of equipment insures uniform standards.
- ***More Durable***
  Greater "ductile strength" is built into the insulation. It does not "powder," settle or disintegrate even with heavy vibration. It withstands handling and may be removed and reapplied if necessary.
- ***Does not Shrink or Warp***
  Steam or water leakage does not affect it. It does not shrink or warp even after soaking.
- ***Attractive Smooth Finish***
  No unsightly, inefficient "bagging." Mundet 85% Magnesia insulation retains its neat appearance and effectiveness.
- ***Precision Pipe Fit***
  No spaces are left for the escape of heat. The whole heated surface is snugly enclosed.

Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7113 Tonnelle Avenue, North Bergen, N. J.

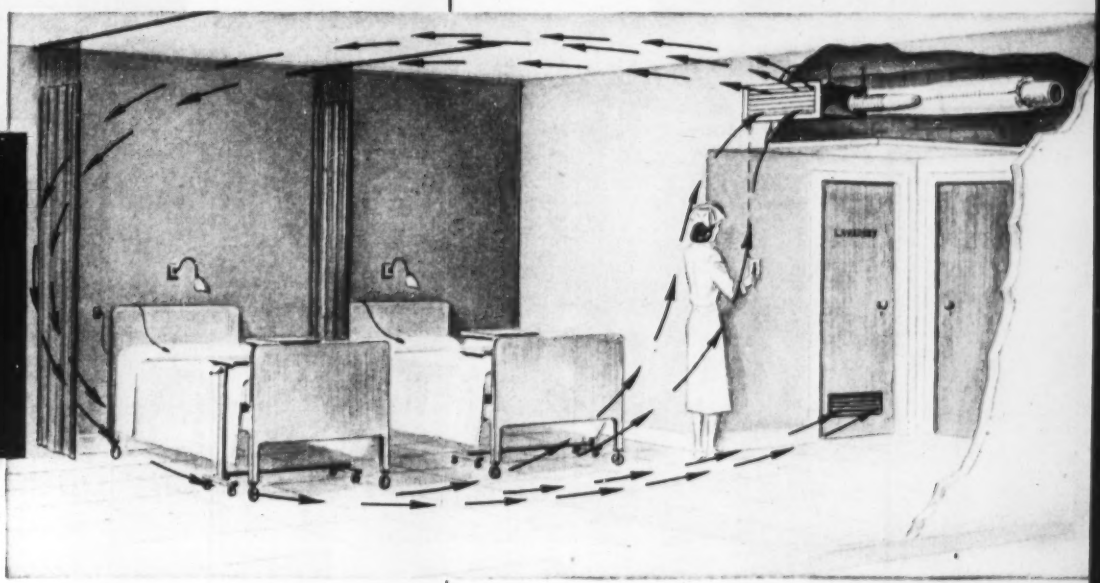
INSULATION FOR HIGH AND LOW TEMPERATURE

Just what the doctor ordered

Anemostat Units for

HIGH VELOCITY

Air Conditioning Systems



For useful engineering data on high velocity, write today for your copy of HV Manual 48.

The illustration shows a typical **hospital** room installation of an Anemostat high velocity unit in the HPSL-100 series. These induction-type units induce into the device a volume of room air up to 100% of the primary air supply according to requirements. They are made for single or dual duct systems, have manual or automatic controls, and may be installed in walls or ceilings.

You will find these units ideally suited not only for hospitals, but also for hotels, offices and similar installations—in new as well as old buildings.

ANEMOSTAT®

DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

The Coupling that gives you these 7 Design Features

1 **ALL STEEL** construction from high grade steel castings with fine tool finished surfaces.

2 **ONE PIECE COVER SLEEVE** is one solid forged steel unit for added safety at high speeds.

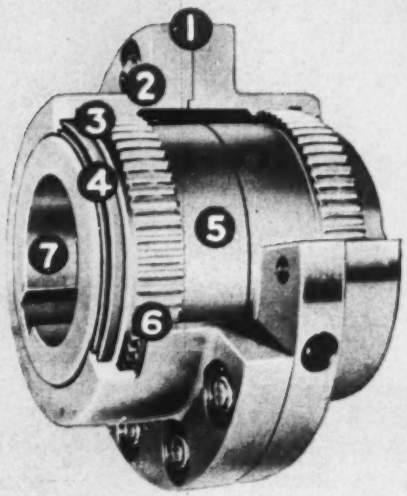
3 **AUTOMATIC LUBRICATION** with ever-present oil film between hub and sleeve to prevent friction or wear.

4 **POSITIVE SEAL** hermetically seals coupling against oil oxidation and keeps ample supply of CLEAN oil inside.

5 **LONGER LINING UP SURFACE** insures easy, accurate initial alignment and full capacity to handle any subsequent misalignments.

6 **COVER SLEEVE BEARING** prevents any added pressure to either shaft; eliminates adverse end crank action on shaft.

7 **LARGER BORE** permits use of smaller physical capacity for same size shaft and reduces rotating weight.



WALDRON GEAR TYPE COUPLING

most economical to buy and to use!

Its design refinements, rugged construction and operating advantages account for the notable performance records of the WALDRON Gear Coupling. Its reputation for providing a longer life of trouble-free service has for many years made it the first choice of practically all leading equipment builders. When you specify WALDRON you are getting maximum protection against coupling failure, costly shut-downs and replacements and damage to expensive equipment. Write for Catalog 57.

- ✓ Available in Standard, Heavy Duty Mill, Mill Motor, Floating Shaft, Jordan, Shear Pin, Cut-Out, Vertical Floating Shaft and Spacer types. A type and size for every purpose.
- ✓ Standard design can be quickly and easily adapted for any special application.
- ✓ Waldron nylon non-corrosive, non-lubricated gear coupling for small fractional H.P. drives. Nothing to wear out. No maintenance.

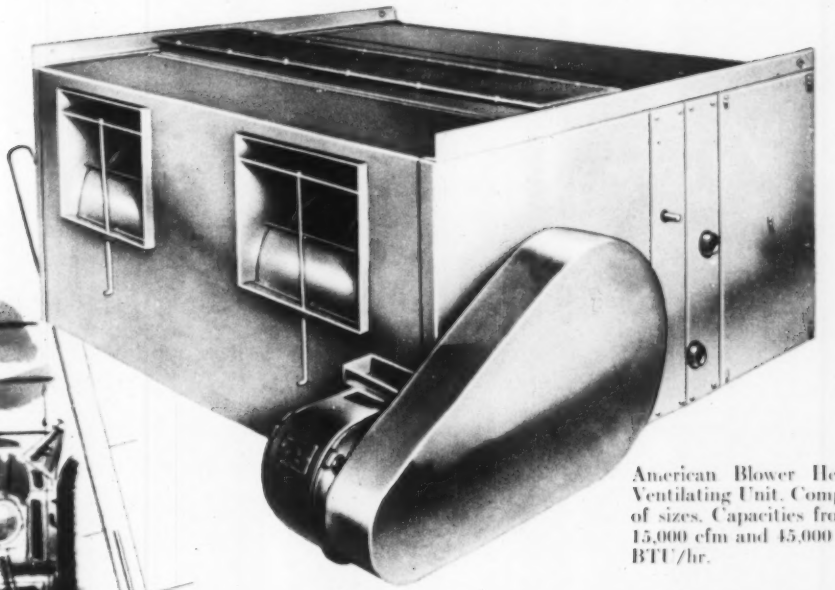
JOHN WALDRON CORPORATION

Waldron Series "A" and Junior Gear Couplings · Francke Pin Type Coupling · Anchor-Waldron Overload Cut-Outs

NEW BRUNSWICK • NEW JERSEY

Sales Representatives In Principal Cities • In Canada—Peacock Brothers, Ltd.

American Blower – a time-honored name in air handling



American Blower Heating and Ventilating Unit. Complete range of sizes. Capacities from 1000 to 15,000 cfm and 45,000 to 976,000 BTU/hr.

That delightfully fresh, pleasant atmosphere which works wonders for employee morale, working and selling conditions, is assured when American Blower Heating and Ventilating Units are installed.

These dependable units, with slow-speed centrifugal fans, are available in a wide range of sizes for wall, horizontal, inverted and floor installation. Each fan housing is equipped with Aileron control. Humidifiers, face and by-pass dampers, filter boxes and mixing boxes are available.

Investigate these efficient Heating and Ventilating Units *now*. Call your nearest American Blower Branch Office for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

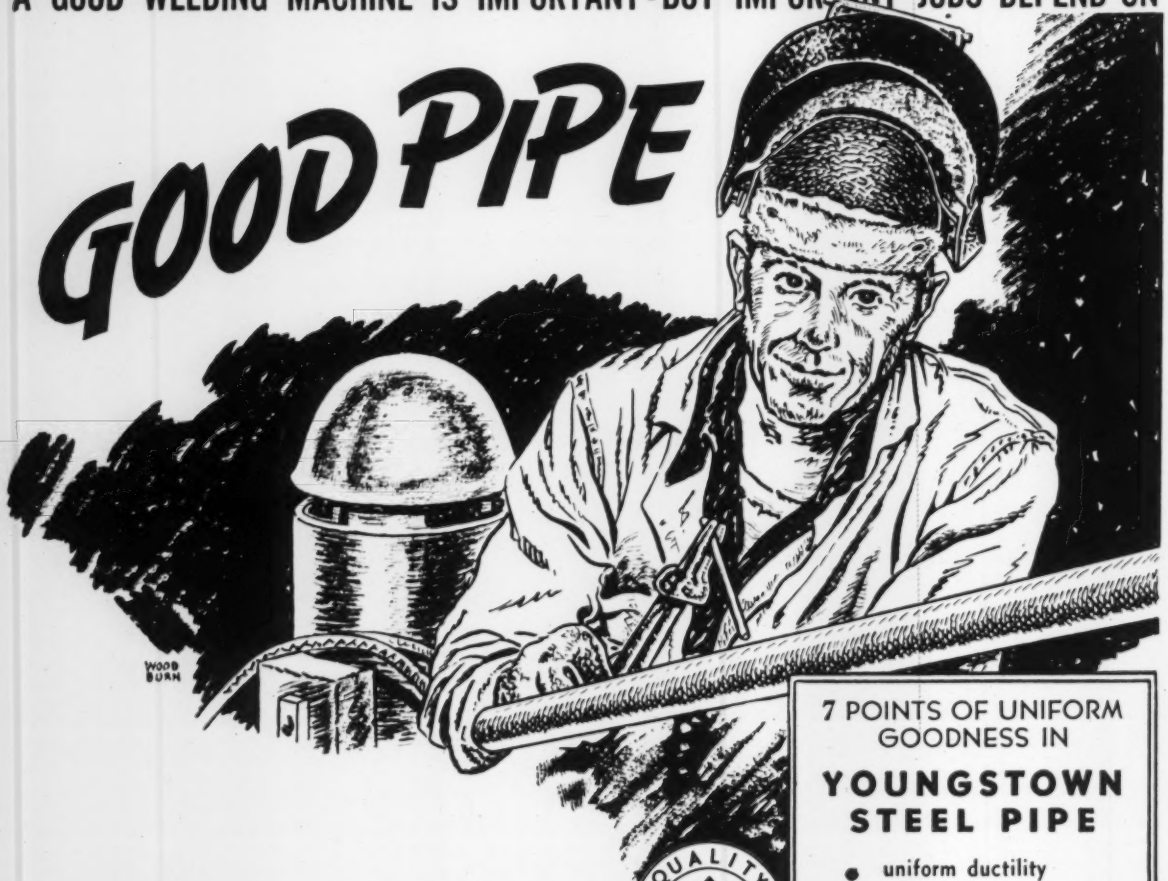
YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

A GOOD WELDING MACHINE IS IMPORTANT - BUT IMPORTANT JOBS DEPEND ON

GOOD PIPE



NO matter how intricate the weld, you do it readily with Youngstown pipe.

That's because Youngstown pipe is designed and made for easy welding—truly round, uniform in wall thickness, uniformly sized, and chemically and metallurgically right. The name "Youngstown" rolled into a length of pipe means it is GOOD PIPE.

QUALITY
YOUNGSTOWN
SERVICE

7 POINTS OF UNIFORM GOODNESS IN

YOUNGSTOWN STEEL PIPE

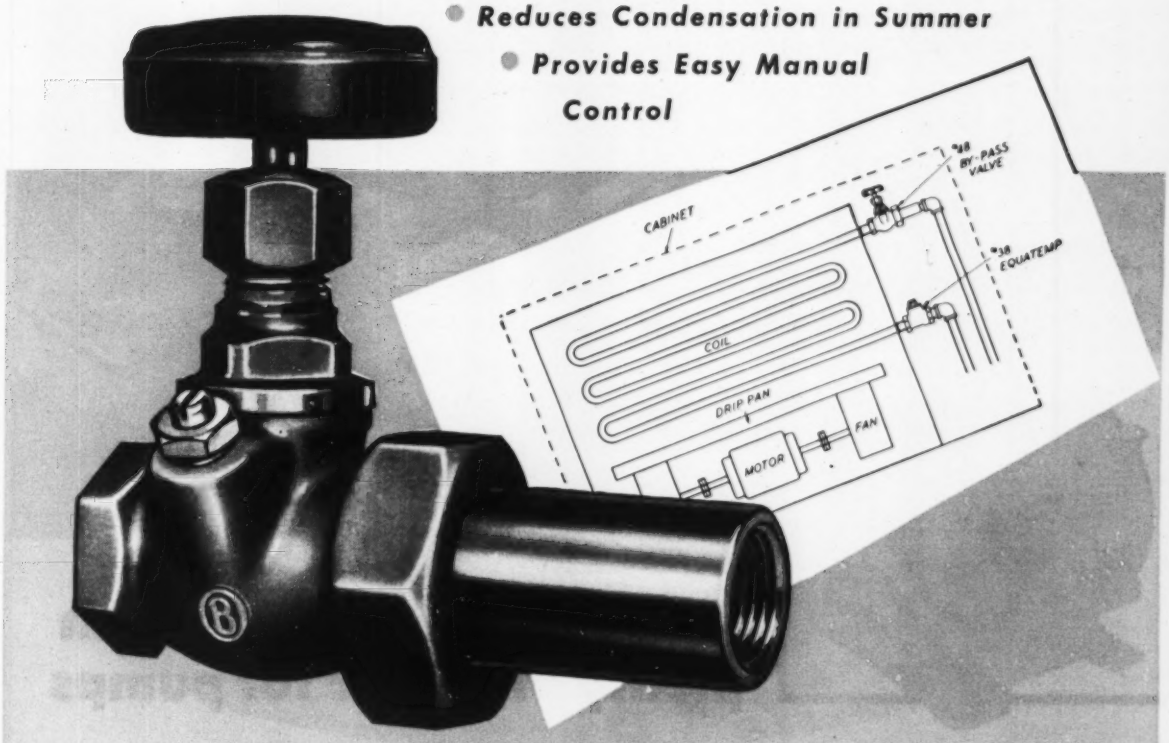
- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

Youngstown
STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY
General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.
PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

New O-B No. 48 By-Pass Valve

- For Air Conditioning Units
- Prevents Freezing in Winter
- Reduces Condensation in Summer
- Provides Easy Manual Control



This new valve is designed especially for use on room units of year-around air conditioning systems. Basically, it's a sturdy globe valve for manual control of room temperature. But probably the most important single feature is the by-pass. It remains open in winter, even with the valve closed, to allow enough circulation to prevent freezing. In summer the by-pass is closed so that no cold water can stand in the unit when it is shut off. This eliminates the danger of excess condensation.

Usual procedure is to install the No. 48 in combination with O-B Equatemp as shown in the line drawing. It can also be used separately from Equatemp®, the valve that both balances and shuts off. The combination of Equatemp and No. 48 valves offers complete temperature control, positive on-and-off regulation, balancing, and provisions for venting, draining and temperature readings. A union nut and tail piece comes with the No. 48 Valve. Send in the coupon below for a folder giving complete information.

Ohio Brass

MANSFIELD · OHIO

BRONZE GLOBES - GATES - CHECKS - ANGLES
FOR INDUSTRIAL, DOMESTIC SERVICE

Ohio Brass Company
Mansfield, Ohio

Please send me the new Equatemp and No. 48 Valve folder, 1271-V.

Name .....

Company .....

Street .....

City ..... State .....

4377-V

Wagner Motors furnish plenty of power for pumps

Motors that drive pumps and compressors need plenty of electrical and mechanical stamina to hold up under the hard, steady grind expected of them.

Fitting the right motor to your pumps is not a problem of special motor designing and building, but of choosing a standard Wagner Motor suited to the job. Wagner Motors are diversified in design and can be readily adapted to a wide range of pump applications.

Wagner Motors are chosen for thousands of pumps because they can deliver plenty of sure, easy, continuous power. They require very little attention—Wagner Motors are designed to keep maintenance at a minimum. They give the kind of service you want—more than sixty years of motor building experience stands behind every motor bearing the Wagner name.

Improve the performance, economy and dependability of your product by choosing Wagner Motors. Bulletin MU-185 gives information on the complete line. Let a Wagner engineer discuss your motor needs with you. Consult the nearest of our 32 branch offices, or write us.

it's to your advantage to standardize with Wagner:

When you standardize on Wagner Motors—you get the advantages of a liberal warranty ... of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 750 Authorized Service Stations. You can choose from a wide variety of types and sizes (from 1/125 to 400 hp).

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

® Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

See our exhibit — Booth 432, 8th All-Industry Refrigeration and Air Conditioning Exposition.

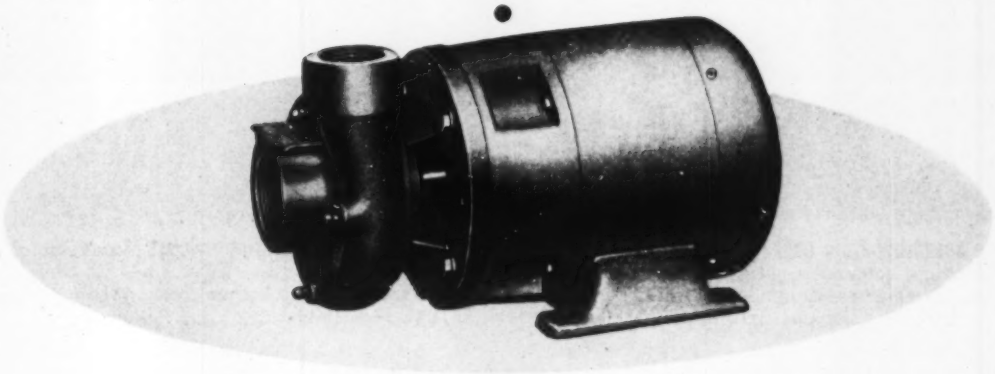
A53-4

high efficiency

The Ingersoll-Rand

MOTORPUMP

the most talked about pump in the air conditioning industry



Advanced design by Ingersoll-Rand gives you . . .

LOW FIRST COST—Designed for higher efficiency, I-R Motorpumps often permit use of *lower* hp pumps to handle jobs normally requiring larger size regular pumps!

HIGHER EFFICIENCY—Tests prove these pumps to be among the most efficient units on the market today!

SPACE SAVING I-R MOTOR PUMPS—Compact, light-weight, require minimum mounting space.

EASY INSTALLATION—Compact design saves extra piping costs. Pumps bolt in any position to floor, wall or equipment. No special foundation needed. No coupling needed, no alignment problem!

LONG, TROUBLE-FREE MAINTENANCE—Put in these rugged pumps and forget them. Motorpumps have been sold for air conditioning service since 1929!

AVAILABLE FOR RUSH DELIVERY—Call the nearest Ingersoll-Rand branch office.

- **SIZES:** ¼ **to 50 hp.**
- **HEADS: to 650 ft.**
- **CAPACITIES: 5 to 1800 gpm.**

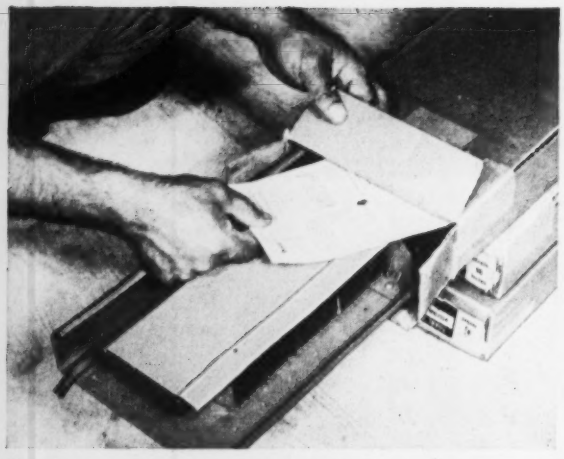
For complete details write for Bulletin.

Ingersoll-Rand

925-9 11 Broadway, New York 4, N. Y.

Low Maintenance

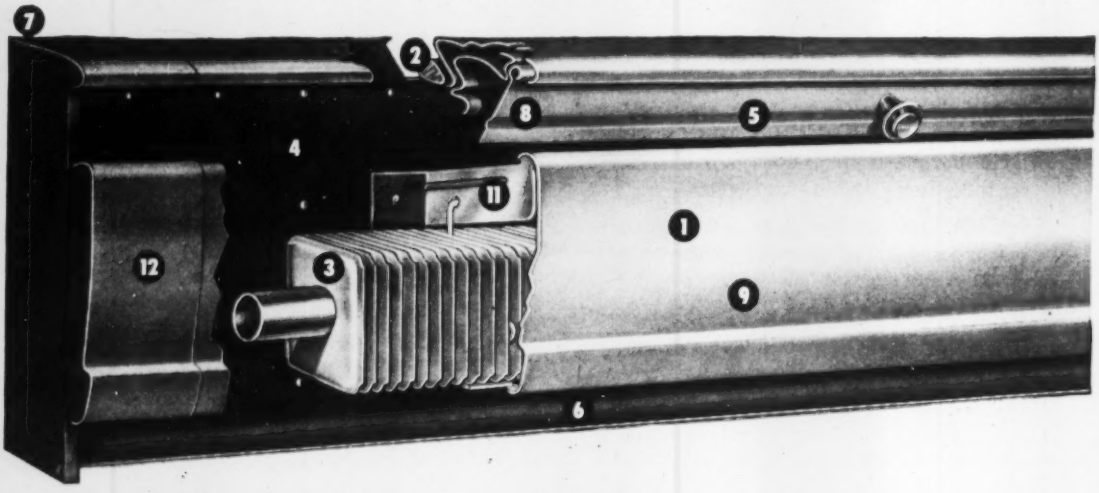
Save hours on the job with Trane Baseboard



1. Remove assembly from package! Basic Baseboard Convector unit comes *assembled* in *one package!* Just slip it out. No parts sorting. Cuts handling time ⅓. Installation instructions in carton.

2. Mount back plate in one piece! No leveling. Mounting holes are factory drilled (on 1½" centers). Fin-and-tube element hangs freely within the cabinet . . . is factory installed.

THE NEWEST ADDITION TO THE NATION'S No. 1 LINE OF MODERN RADIATION . . .

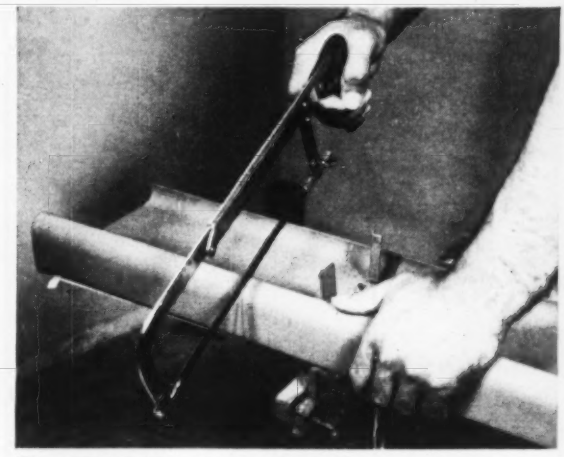


You can save labor and shave costs with this

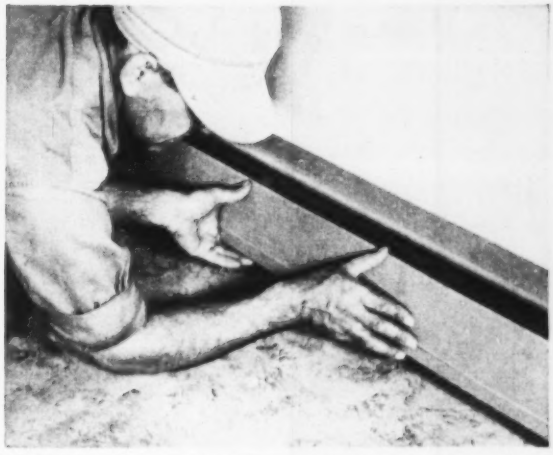
beautiful new TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

new Convectors! Here's how...



3. Trim to fit any job dimensions! No complicated fitting. Only two cabinet parts to measure and cut. Back plate and front panel are roll-formed and contoured for extra strength and beauty.



4. Snap on front, joiners, corners! No special tools, no sheet metal screws. Snap-on joiners, end pieces, corners cover all metal edges. Even the damper snaps in. Helps cut installation time in half.

Installs easier because it's built better . . . 12 ways

1. Snap-on front—no sheet metal screws, no sheet metal drilling
2. Full-length back-to-wall rubber seal—prevents dirt seepage
3. Famous TRANE fin-and-tube—aluminum fin, copper tube, mechanically bonded
4. One-piece back and top—minimum parts quickly installed, mounting holes provided
5. Uninterrupted outlet—blends unit into wall . . . prevents dirt patterns
6. Reverse radius at bottom—eliminates quarter round, speeds installation
7. Universal unit—free-standing or semi-recessed . . . 2 heights, 2 capacities
8. Snap-in damper—no screws, hinges, levers or chains
9. All parts roll and die-formed—to assure quick, accurate assembly
10. Snap-on joiner pieces—fit tightly, completely cover joints
11. Coil hanger—allows free expansion, designed to end noise
12. End caps—feature snap-on fronts for easy accessibility

TRANE CONVECTORS

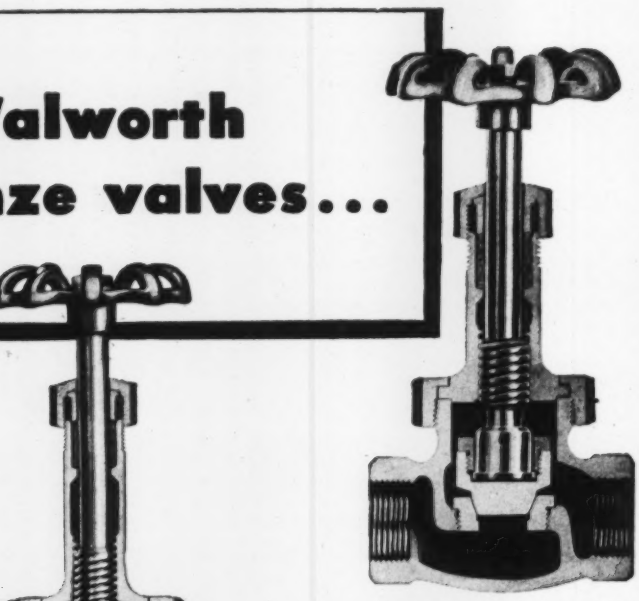
TRANE WALL-FIN

Baseboard Convector

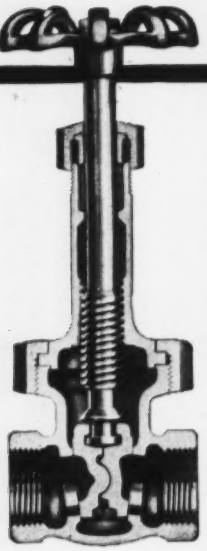
For complete information on capacities, roughing-in dimensions, control diagrams, see your nearby TRANE office or write TRANE, La Crosse, Wis.

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U. S. and 14 Canadian Offices

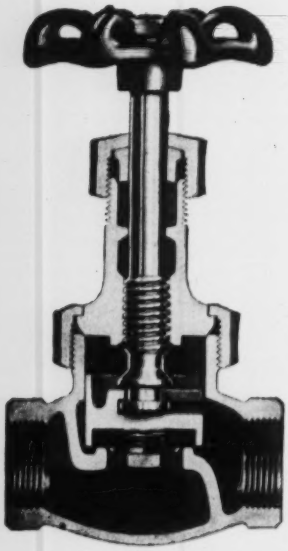
Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

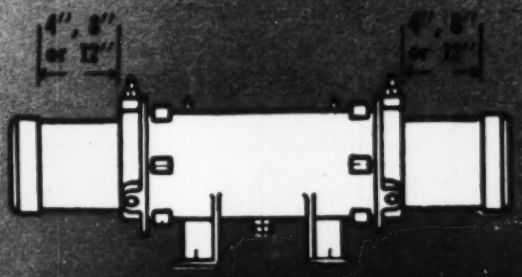
For full information about Walworth Quality Bronze Valves, see your Walworth distributor, or write:

WALWORTH
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

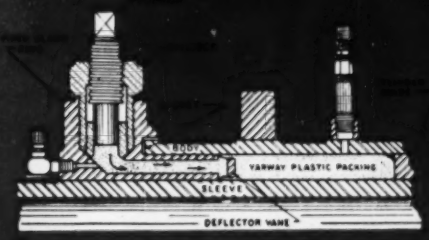
YOU NEED FEWER JOINTS



With Yarway Gun-Pakt slip-type expansion joints you need *fewer* joints than with other types, because each sliding sleeve has a traverse of 4", 8" or 12"... maximum expansion being 24" for a double-end joint.

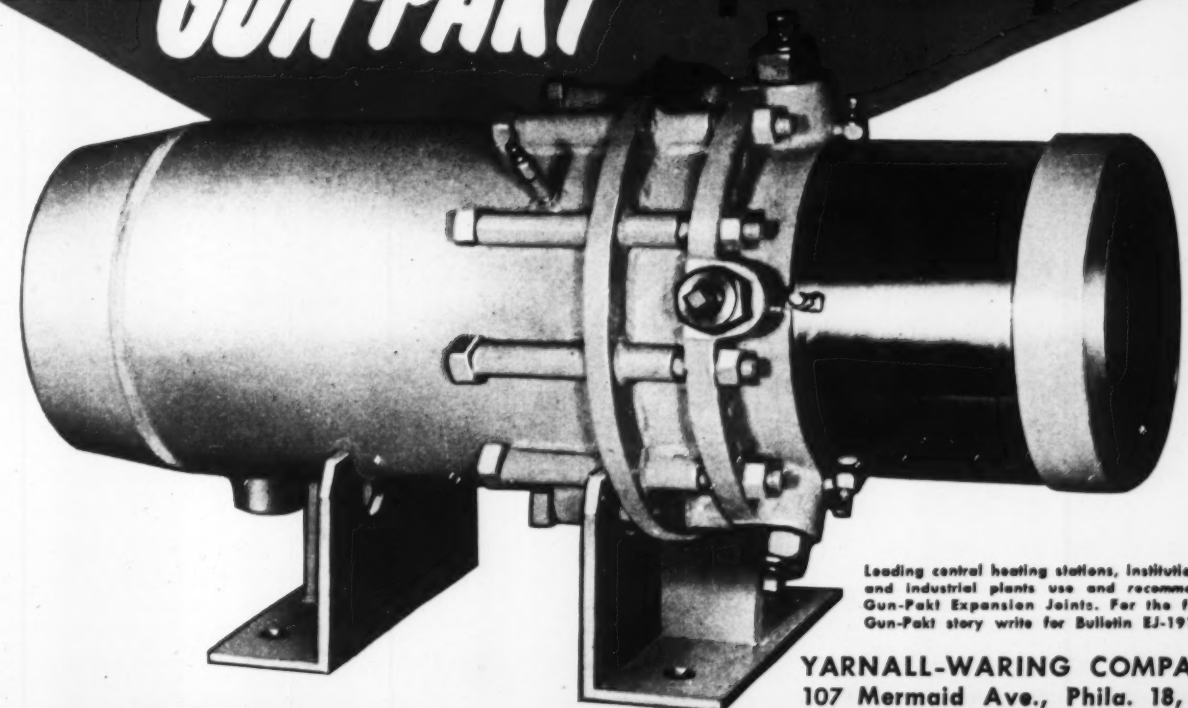
For example, one single-end Yarway Gun-Pakt joint with an 8" traverse is all that is needed for a 200 ft. run of steel pipe carrying saturated steam at 250 psi.

AND LESS MAINTENANCE



No need for shutdowns. Yarway Gun-Pakt joints are repacked under full steam pressure. Just insert a plug of Yarway plastic packing, twist a wrench and the job is done. Maintenance and production overhaps are saved!

with GUN-PAKT expansion joints



Leading central heating stations, institutions and industrial plants use and *recommend* Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

NO Reducing Valve Needed

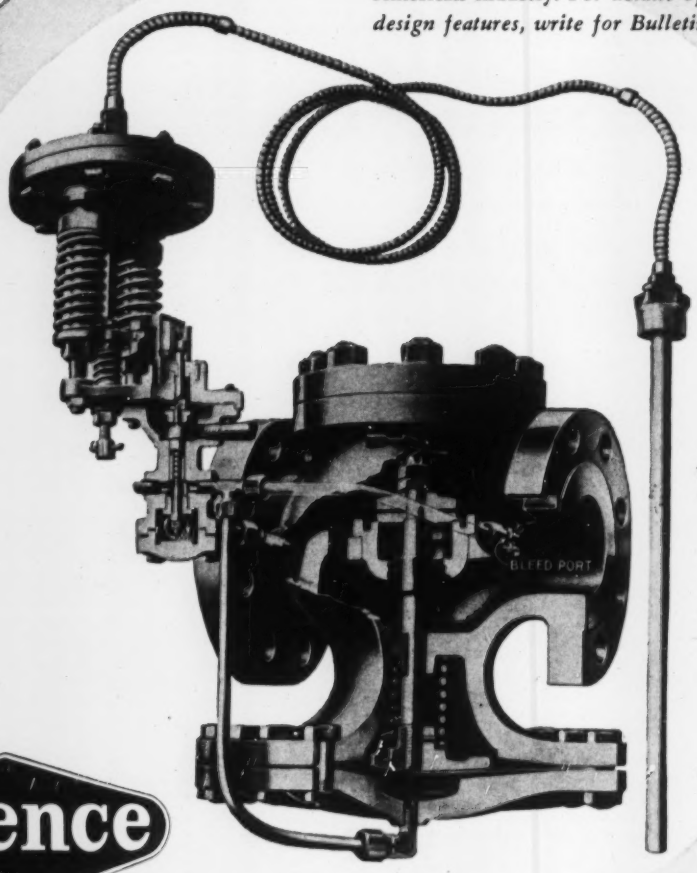
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



SPENCE
TYPE ET150
Temperature
Regulator

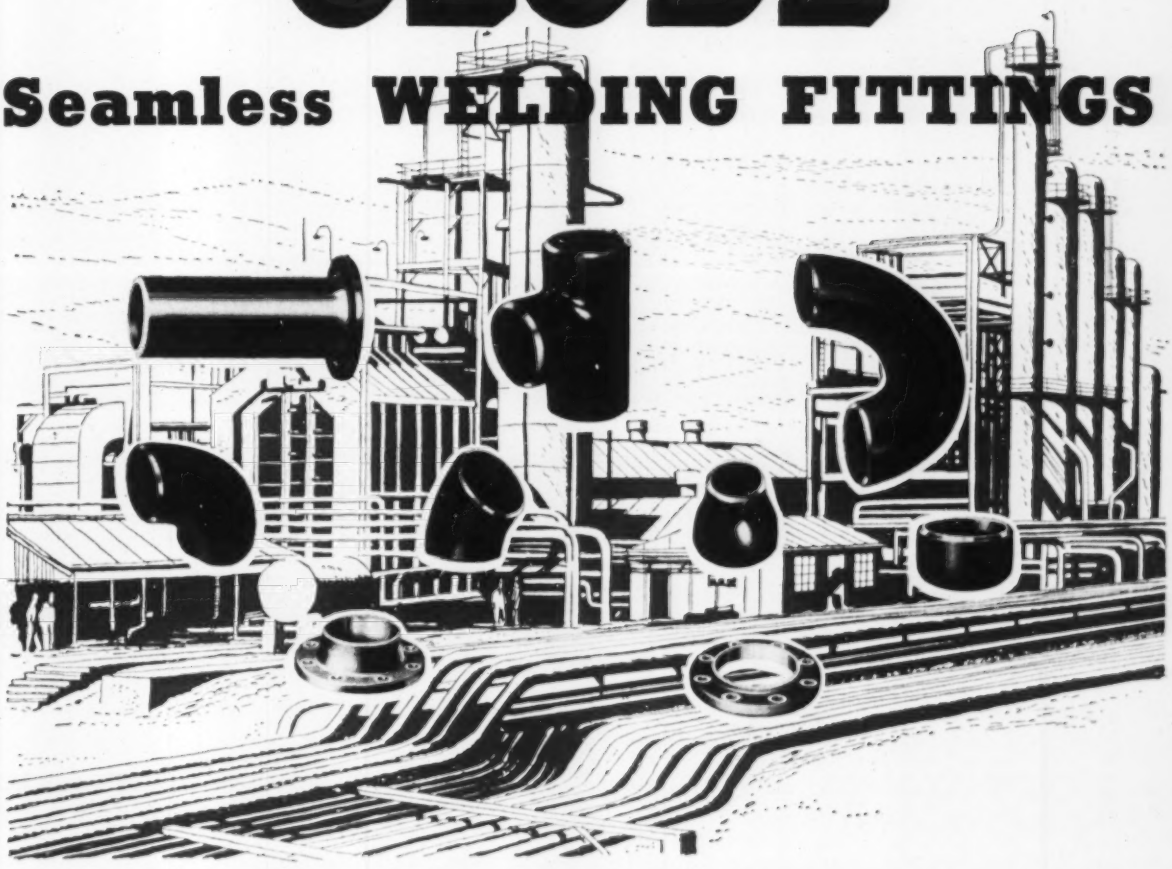
Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

SE-131

GLOBE

Seamless WELDING FITTINGS



The only seamless welding fittings precision-processed . . . from billet . . . to tube . . . to fitting

From charging the specially designed revolving furnace with a steel billet (above) through the many succeeding steps of production, every Globe process is specialized to produce fittings of unvarying quality.

Globe precision-process manufacture begins with the billet —continues through the making of the seamless steel tube (Globe alone among welding fittings manufacturers produces seamless steel tubes)—and extends through to the production of the finished fittings.

Because Globe has highly specialized controls—at every stage of manufacture at its own plant—you can be sure of uniform high quality seamless welding fittings when you specify Globe.

Send for the Globe Welding Fittings complete catalog.

GLOBE STEEL TUBES CO.,
Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis • Denver • Houston • San Francisco
Glendale, Cal.

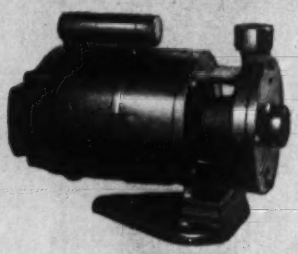
Producers of Globe Welding Fittings — Globe seamless stainless steel tubes — alloy-carbon seamless steel tubes — Gloweld welded stainless steel tubes — Globeiron (high purity ingot iron) seamless tubes.

AVAILABLE IN A COMPLETE LINE OF SIZES AND WEIGHTS THROUGH GLOBE DISTRIBUTORS IN ALL KEY CITIES

ALLIS-CHALMERS
Air Conditioning
PUMPS

Easy-to-Install pumps

MEET 90% OF AIR CONDITIONING NEEDS



FHP pump

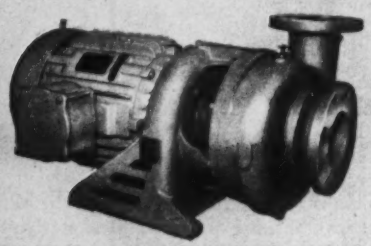
Up to 80 gpm, heads to 125 feet.

Compact pump and motor requires only two bolts for installation. Rigid construction holds alignment for longer bearing and seal life. Mechanical seal. Open impeller economy model does adequate job on many installations at very low cost. Closed impeller model for higher heads. Also available as frame-type pump for separate mounting.

Electrifugal pump

Up to 500 gpm, heads to 220 feet.

Only pump with unit-cast frame. Motor and pump are mounted on a single shaft in a one-piece rigid cast-iron frame. Alignment is rigidly held but there is plenty of space for maintenance. Installation requires only four bolts. Standard packing or mechanical seal available. Also built as frame-type pump for separate mounting.



Supporting adapter pump

Up to 2500 gpm, heads to 550 feet.

Flange motor and pump mounted on sturdy cast-iron supporting adapter. Motor and pump use same shaft. Rigidity assures vibrationless operation and long bearing life. Only four bolts required for installation. Available with standard packing or mechanical seal. Built in same ratings as frame-type pump for separate mounting.

FREE ENGINEERING HELP

YOUR ALLIS-CHALMERS PUMP REPRESENTATIVE is thoroughly familiar with pump problems in air conditioning equipment. He can offer you valuable suggestions in planning your equipment and installations. Call your Allis-Chalmers Authorized Distributor or District Office when you need help with your pump problems.

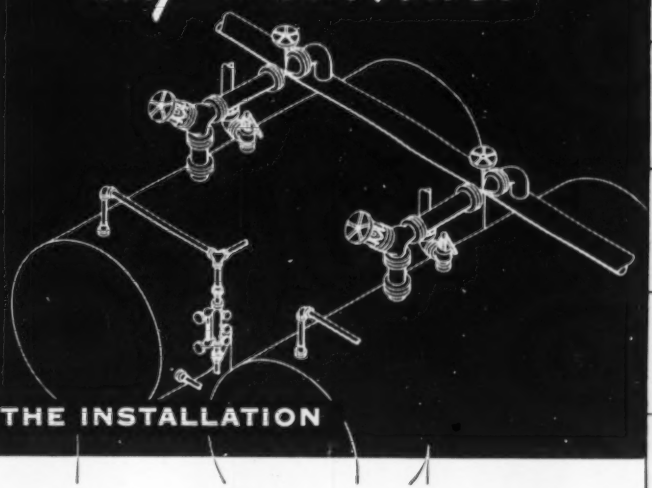
Write Allis-Chalmers, Milwaukee 1, Wisconsin, for centrifugal pump Bulletins 52B7529, 52B6140 and 52B6083 describing these air conditioning pumps.

A-3971

Electrifugal is an Allis-Chalmers trademark.

ALLIS-CHALMERS

30 Years of Safety and Efficiency with these High Quality Stop-Check Valves



THE INSTALLATION

At the Eureka Redwood Lumber Company, Eureka, Calif., featuring eight 5-in. Crane stop-check valves on boiler lines to main steam header.

VALVE SERVICE RATINGS

SUITABILITY:	On the job for 30 years
FEATURES:	Only one moving part
MAINTENANCE COST:	One seat regrinding only
SERVICE LIFE:	Installed 1923 – still O.K.
OPERATING RESULTS:	Efficient performance — safe operation
AVAILABILITY:	Crane Catalog item – No. 30E

THE CASE HISTORY

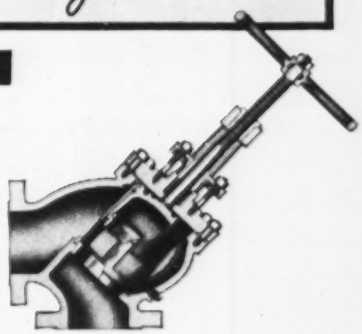
Thirty years' continuous service is by no means the record for Crane 250-Pound stop-check valves. But when 6 such valves, all installed in 1923, are still on the job, and still giving complete satisfaction, surely that's worthy of note. So well did these Crane No. 30E stop-checks perform right from the start, that 11 years later, in 1934, 2 more were put on boilers installed that year.

Here are 8 valves with a collective service record of more than 220 years. And in all that time, the only maintenance required was regrinding the seat of one valve.

It takes a lot of quality to deliver such valve performance with so little upkeep. That's why today, in face of rising maintenance cost, Crane quality is more than ever the first choice of the thrifty valve buyer.

THE VALVE

Simplicity and dependability are still the chief characteristics of Crane 250-Pound stop-check valves. They have just one moving part—the piston-type disc that operates in a removable liner, without chatter, vibration, or rapid wear. You'll have a safer power plant with these valves on your boilers, and they'll permit steam flow to the main header at minimum pressure drop. See your Crane Catalog or Crane Representative for complete information.



THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

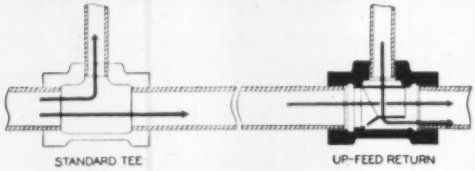
CRANE VALVES

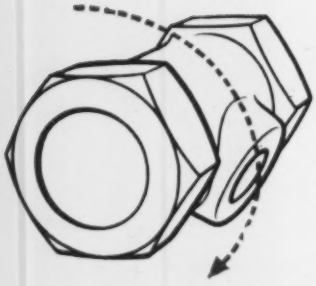
CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

ONLY ONE MONOFLO FITTING NEEDED FOR MOST INSTALLATIONS

Install a Monoflo Fitting at either the supply or return riser—results are equally effective





Special Down-feed Fittings eliminated

Different Monoflo Fittings for up-feed and down-feed radiators are not required. By *revolving* either a Supply Fitting or Return Fitting so that the riser opening is down, it can be used for down-feed radiators.

B & G Monoflo Fittings enable you to design a one-pipe forced hot water system with assurance that it will be correctly and efficiently circulated. That's because the Monoflo Fitting is an *engineered* device—not just a "scoop" or "choke."

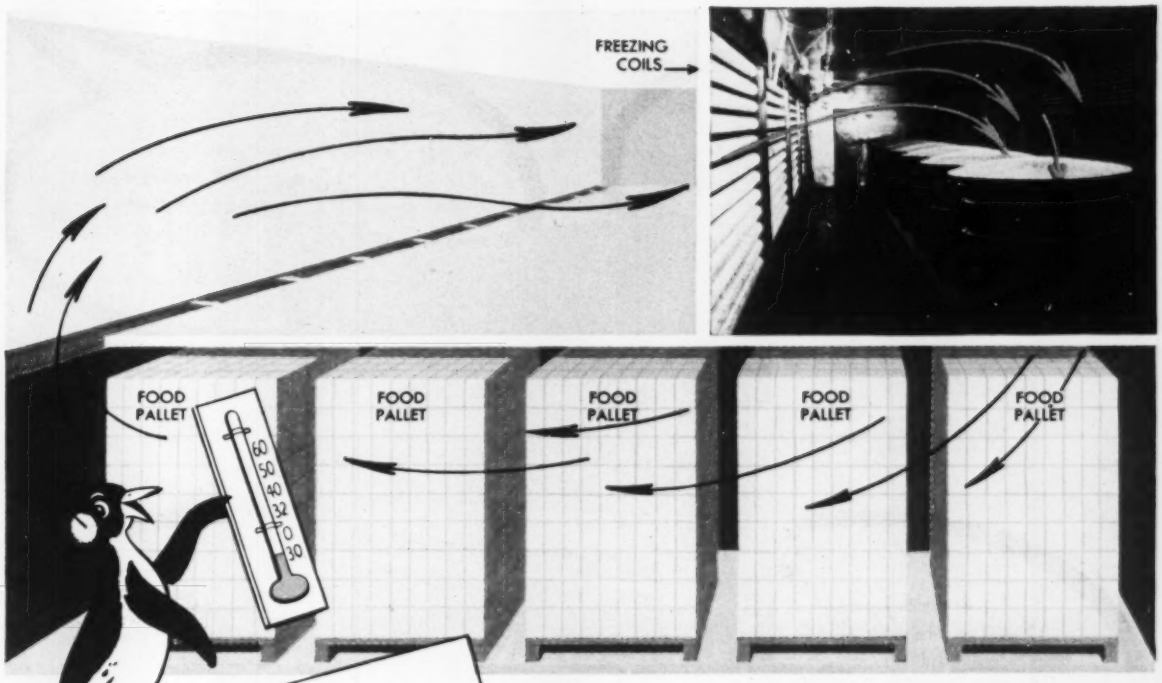
Under average conditions, *a single Monoflo provides ample diversion capacity!* In abnormally long pipe runs or where unusually large heating loads must be handled, a Monoflo Fitting may be required at both supply and return risers. Down-feed radiation likewise requires two Fittings.

Here's the important point! It would be no trick at all to build enough resistance into Monoflo Fittings so that one fitting would be sufficient under all circumstances. But remember this...*every average job would then be penalized with excessive resistance!* This is particularly true in large installations.

So why waste power... why over-circulate one radiator in order to properly supply another... why take a chance on a noisy system because of excessive water velocity. Use B & G Monoflo Fittings—*correctly designed for most efficient performance!*

See the B & G Handbook for complete data on B & G Monoflo Fittings.

BELL & GOSSETT
COMPANY
Dept. DC-5, Morton Grove, Ill.
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada



JOY AXIVANE FANS®

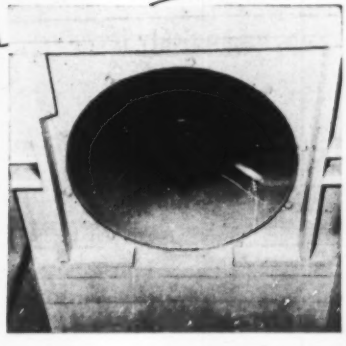
HANDLE SEVERE QUICK-FREEZE JOB

A West Coast quick-freezing plant boasts an effective operation that utilizes 24 Joy 7½ HP Series 1000 Axivane Fans, installed in two groups of 12 each.

Note the illustration above. The upper floor contains freezing coils and a row of 12 fans. The floor below is partitioned into narrow freezing tunnels, each served independently by a single Joy fan.

As air passes through the freezing coils, it is cooled to between —30° and —35°. This sub-zero air is propelled down and through the tunnels below, which contain pallets of meat, vegetables, fruit, etc. to be quick-frozen. After passing over the food, the air is again cooled and circulated. At full plant load, each 12-fan battery handles 242,000 CFM of air.

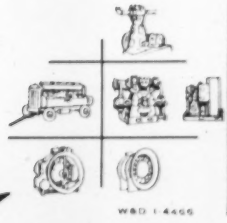
The relatively quiet operation, light weight, compactness and low power consumption of Joy Axivane Fans—due to the unmatched efficiency of their vaneaxial design—have proved *real* advantages on this job. Their in-line construction also saves space, since each fan can be mounted right in its short, vertical duct. In addition, extreme flexibility of operation is made possible by the adjustable blades, a standard Joy feature. ● Let us help you to get best results on your fan problems. **Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



Left: Looking up from the quick-freeze room below a Joy Axivane Fan. Note the compact, economical use of space and the simple mounting.

Consult a Joy Engineer

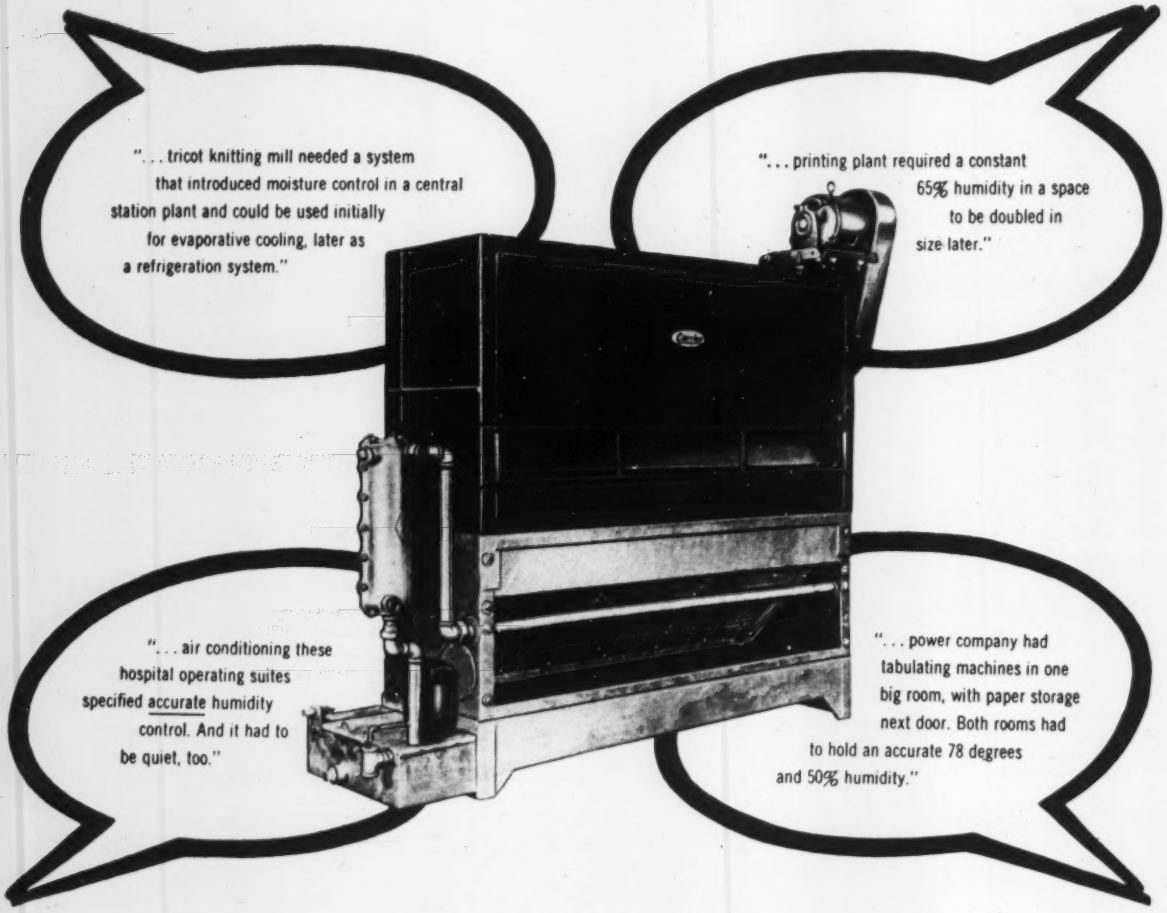
for Vaneaxial Fans . . . Compressors, Vacuum Pumps and Boosters . . . Oxygen Generators



W&D 1-4405

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885


"... tricot knitting mill needed a system that introduced moisture control in a central station plant and could be used initially for evaporative cooling, later as a refrigeration system."
"... printing plant required a constant 65% humidity in a space to be doubled in size later."
"... air conditioning these hospital operating suites specified accurate humidity control. And it had to be quiet, too."
"... power company had tabulating machines in one big room, with paper storage next door. Both rooms had to hold an accurate 78 degrees and 50% humidity."

In case after case, only a Carrier Industrial Weathermaker could fill the bill

- **controls temperature and humidity *accurately***
- **flexible**
- **quiet**
- **compact**
- **easily and quickly installed**

In actual sales experience, the Carrier Industrial Weathermaker has won contracts on the basis of performance and quality rather than price.

Its superior control of humidity alone outclasses competition for textile mills, hospital operating rooms, equipment rooms and laboratories . . . doing the job of many more elaborate and expensive "tailor-made" or built-up systems.

Even for comfort jobs, you'll find many buyers want to invest the few extra dollars to get the advantages of a spray-coil unit.

For year-round service, the Carrier Industrial Weathermaker cools, dehumidifies, heats and humidifies. Coils available for direct expansion or chilled water application.

Contractors! This line of Industrial Weathermakers, in five capacities, is available to you. Your local Carrier Dealer or Branch Office will give you full information. Look in the Classified Telephone Directory. Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

Ask any user about

"DIVIDEND$ UNLIMITED"

FROM Ramset System

FASTENING SYSTEM

FOR FASTENING INTO STEEL AND CONCRETE

Outnumbering all other makes combined by better than 2 to 1, RAMSET SYSTEM is the undisputed leader among powder-actuated fastening methods. For six years, thousands of users have proved that strong, sturdy RAMSET Tools, with many built-in features and the widest variety of Tru-Set Fasteners, pay "**DIVIDENDS UNLIMITED**," like these:

CASH SAVINGS—costs reduced from $2.53 to 24 cents per fastener . . . saved $15,000 on 50,000 fastenings . . . cut over-all cost by 87 per cent.

TIME SAVINGS—fasten 15 to 1 faster . . . cut time from 9 minutes to 58 seconds . . . get jobs completed and paid for in far less time.

WORK SAVINGS—effortless operation increases productivity without fatigue . . . lightweight, compact tools workable in tight spots . . . one-hand operation a big advantage.

WIDE UTILITY—choice of 3 RAMSET Tools, and the most versatile line of Tru-Set Fasteners, provide the right tool and right fastener for every job . . . RAMSET SYSTEM does more work than any other method.

Wherever there's fastening work to do into steel or concrete, RAMSET SYSTEM pays "**DIVIDENDS UNLIMITED**" on job after job, year after year. Call your dealer or mail the coupon for on-your-job demonstration.

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

12109 BEREA ROAD • CLEVELAND 11, OHIO

Please send us details on use of RAMSET SYSTEM for steel and concrete fastening.

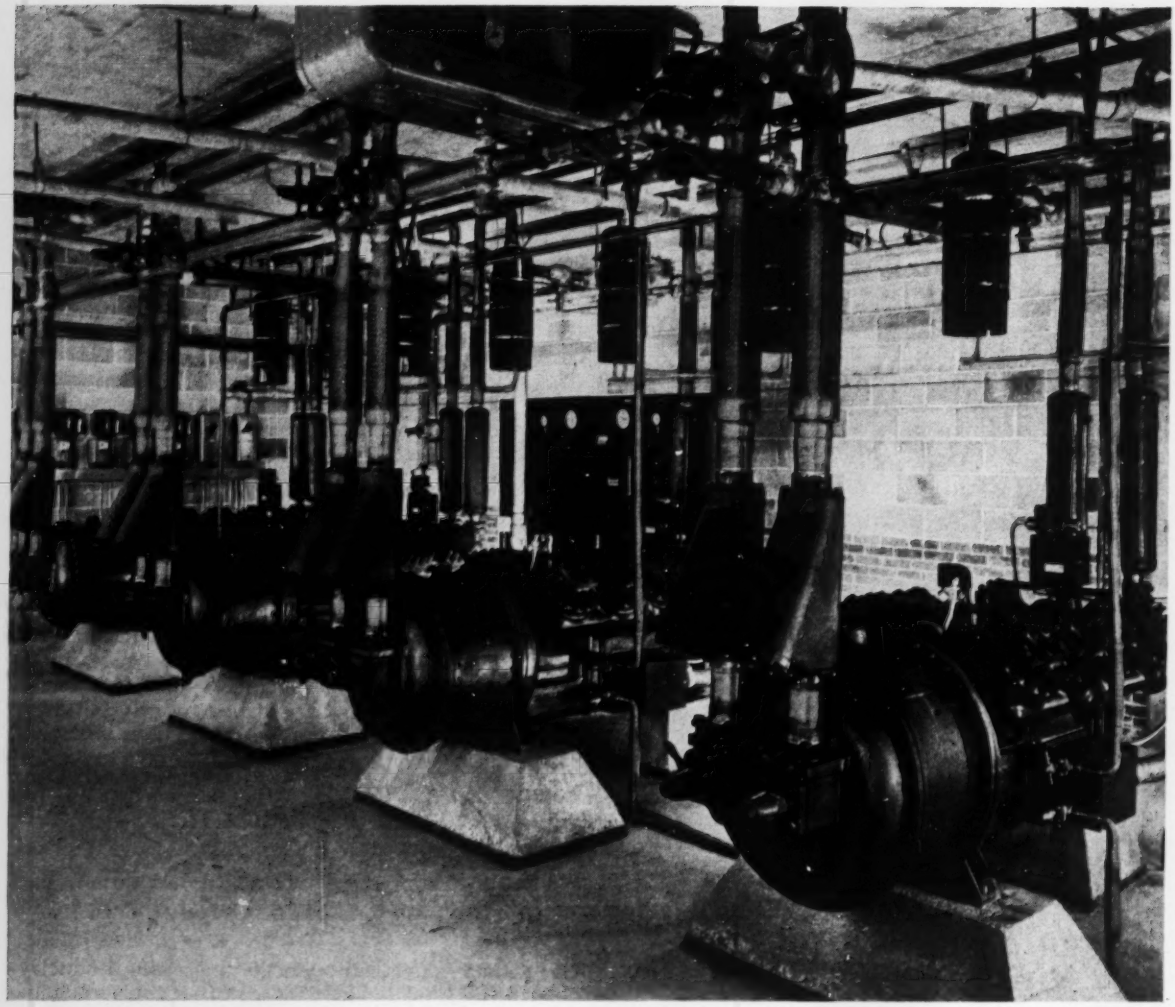
Name _____

Company _____

Address _____

City _____

HP-9



Vibration is isolated from the copper piping of this 400-ton installation

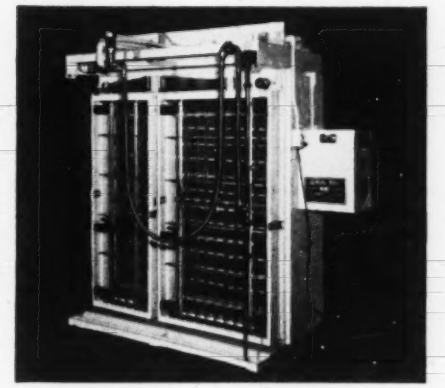
The thoughtful design of piping for this air conditioning system, installed in a large western newspaper plant by The T. C. Alexander Co. of Denver, is clearly apparent in the care taken to isolate compressor vibration. Note that the connection of every ANACONDA Copper Tube to every compressor is made through an American Vibration Eliminator.

The ANACONDA Copper Tube used throughout this installation ranges in size from 1⅜ in. to 5⅛ in. O.D. Return lines to the four 100-ton compressors are brought back through two 5⅛ in. O.D. copper lines to a common header. Two 4⅛ in. O.D. copper discharge lines similarly run from a common header. Crankcase and oil equalizer lines are also copper of 1⅜ in. O.D. with Vibration Eliminators at each compressor. The entire installation is automatic in operation, each unit being brought into the line by a sequence control system according to the load demand.

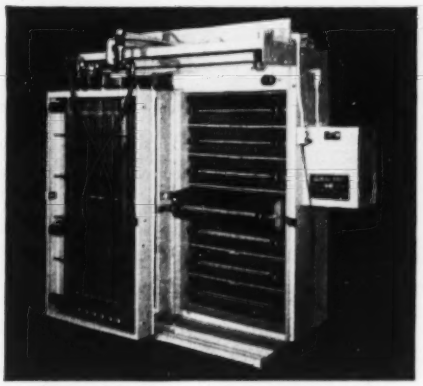
ANACONDA Copper Tubes with ANACONDA Solder-Type Fittings make a quality job of any piping installation. And wherever vibration is a factor, be sure to isolate it with American Vibration Eliminators. Your Anaconda Distributor can furnish you with ANACONDA Copper Tubes, Fittings and Vibration Eliminators. Order through him. *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.* 5331

ANACONDA®

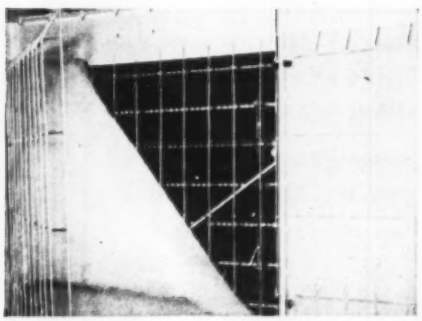
MAKERS OF
COPPER TUBES AND FITTINGS and AMERICAN VIBRATION ELIMINATORS



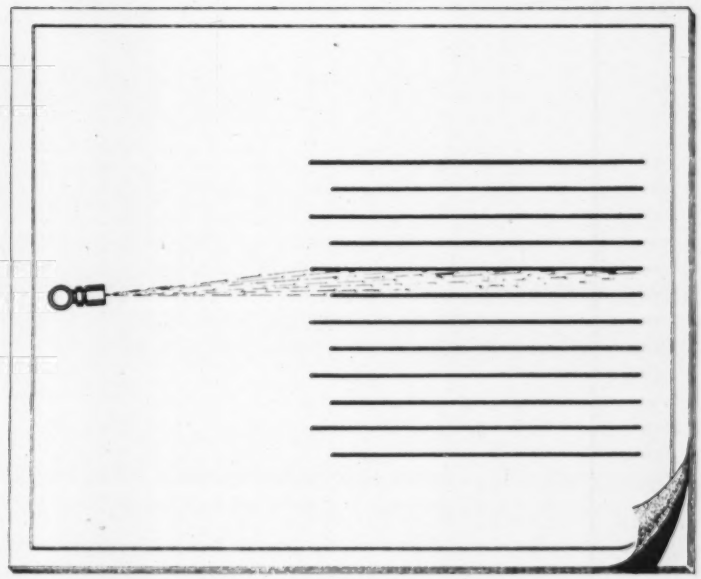
The above illustration shows the hinged ionizer section closed with the new Type "H" Washer in normal position when precipitator is operating. A push-button switch, located on the right-hand side of the above illustration, operates the washer and opens the solenoid valve that controls the water supply. The header makes a complete trip across the face of the precipitator and returns, automatically, to the starting position where it contacts a limit switch that breaks the electrical circuit.



In the above illustration the ionizer section has been opened to show that the washer does not interfere in any way with access to the collector assembly. As in the standard Electro-Cell, the plates are completely removable for thorough cleaning or inspection whenever necessary without the use of any tools or accessories whatsoever.



This illustration shows that the water eliminator frame has been opened to show density of the AMER-glas blanket and the ease with which the pad may be removed from the precipitator. If the precipitator is properly maintained and energized electrically at all times during fan operation, the afterfilter will require a minimum amount of attention. Because it is made of fine hair-like glass filaments, the pad is easy and pleasant to handle.



here's the reason for the 5° lead on the traveling spray nozzles

on the

ELECTRO-CELL TYPE "H" WASHER

The new type "H" Washer is incorporated as an integral part of the ELECTRO-CELL precipitator and provides "push-button" control of the cleaning operation—thus greatly reducing maintenance and increasing the efficiency of the famous ELECTRO-CELL.

The outstanding feature of the new Type "H" Washer is the rotation of the header at each end of the travel to advance the spray nozzles approximately 5° from the vertical. Result—the best possible penetration of the spray water, assuring thorough coverage of the entire depth of the collector plates with the resulting maximum cleaning action and a minimum of water!

The Type "H" Washer is another "first" from AAF and offers better cleaning efficiency and water economy advantages over the standard fixed-nozzle method of "flooding".

Write the American Air Filter Company for technical data and descriptive information on this latest AAF achievement. And remember—AAF experience will help you solve all your air cleaning problems.

expect the best from ..... AAF

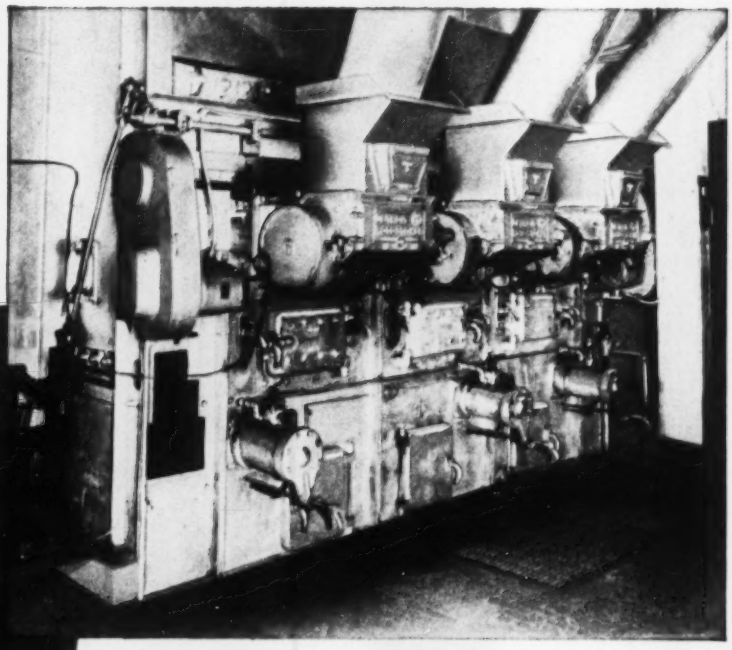
American Air Filter

COMPANY, INC.

373 Central Avenue, Louisville 8, Ky.

American Air Filter of Canada, Ltd., Montreal, P. Q.

15%



NEW DETROIT ROTOSTOKER FIRED BOILER

This installation, at General Mills, Inc., Buffalo, N. Y. plant is typical of Detroit RotoStoker performance. Not only was there a 15% fuel saving—smoke nuisance, long a problem, was eliminated.

Detroit RotoStokers burn economically any Bituminous Coal or Lignite without special preparation. They increase boiler capacity and respond quickly to sudden changes in load. Fuel is fed by efficient Overthrow Rotors. Fine fuel is burned in suspension—coarser fuel on the grates with uniform, but comparatively thin fuel bed.

Hundreds of Detroit RotoStokers are successfully applied to all makes and types of boilers or steam generators.

Do you need more steam at lower cost? If so, investigate the RotoStoker. Write for Catalog.

6215

DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

General Motors Building · Detroit 2, Michigan

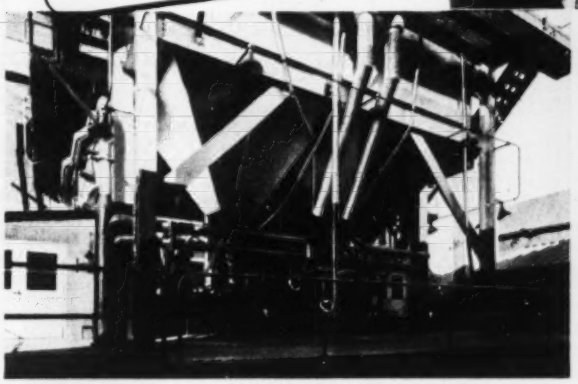
Works at Monroe, Michigan · District Offices in Principal Cities

"We modernized our plant, installed new COAL-burning equipment, AND CUT OUR FUEL COSTS 45%!"

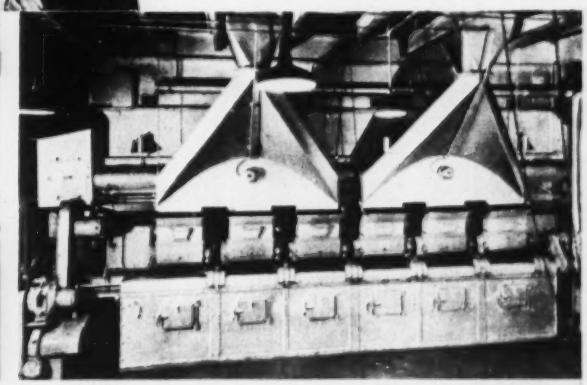
says MR. A. J. GOETZ, Executive Vice President, River Raisin Paper Co., Monroe, Michigan.

"We recently modernized our entire plant following an extensive engineering survey. New coal-burning and coal-handling equipment was installed . . . heat losses were reduced . . . efficiency raised. As a result, our fuel costs have been cut 45 to 50%—proving to us that you just can't beat bituminous coal burned the modern way."

"In Addition, Automatic Coal- and Ash-Handling Equipment Cuts Labor Costs 60%!"



This view shows how River Raisin has installed its modern fly-ash reinjection system at the rear of the boilers but outside the plant. The plant also features outdoor coal handling to save additional interior space.



"We chose these modern spreader stokers for their advantages of low maintenance, low power requirements, and their ability to meet fairly rapid load changes. They give us maximum efficiency under all operating conditions."

Modernizing your present plant? Building a new one? In either case let a consulting engineer show you exactly how you can meet your *specific* needs with a modern coal installation—and at the same time save more money than you thought possible.

Automatic coal- and ash-handling equipment can cut your labor costs to a minimum. And, today, with a modern combustion installation, you can actually get 10 to 40% more power from each ton of coal than was possible a few years ago.

Moreover, with coal you'll never have to worry about a shortage of fuel. America's coal reserves are virtually inexhaustible, and this coal is mined by one of America's most efficient and productive industries. This means that coal users—unlike those committed to other fuels—get the advantage of dependable future supply as well as more stable prices.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY ... FOR LOW COST

YOU CAN COUNT ON COAL!

"Buffalo"

Tips on Better Pumping

A SUMP PUMP
May Be Your Answer!

The sump pump offers advantages worth considering for many chemical and other industrial applications. These are based on the fact that a sump pump operates submerged, vertically.

1. No Stuffing Box To Maintain

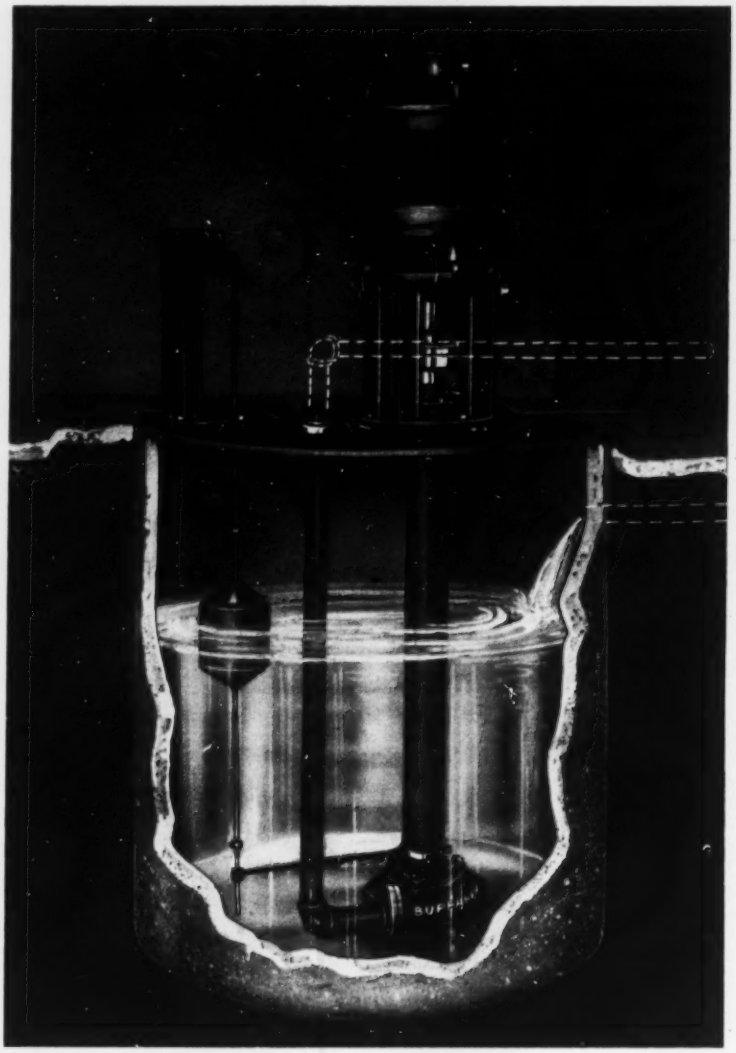
Submerged, vertical operation means that no stuffing box is necessary in the casing next to the impeller. In "Buffalo" Pumps, the hydraulically balanced impeller reduces thrust load.

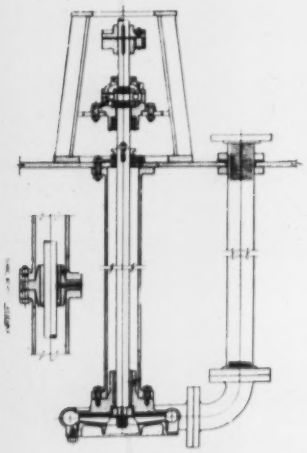
2. Always In Positive Prime — No Suction Lift

As long as there is liquid in the sump or tank, the pump will be in prime. Pipe friction and height of outlet are your only head. Efficiency is high—especially high with the "Buffalo" enclosed impeller.

3. Self-Contained Unit

Your "Buffalo" Sump Pump arrives ready to place in the sump or tank, connect to power supply and start operating. The shaft is coupled to the motor, in permanent alignment.





Left, Special Pumps For Hot Liquids And Acids, where fumes are objectionable or where sump is under pressure, are available with a special stuffing box at cover plate, as shown. Note guide bearing, an optional feature.

Efficiency Features In "Buffalo" Sump Pumps . . . include entirely enclosed shaft with ball bearing thrust—long, water-lubricated bronze sleeve bearing at pump—choice of sizes from 1" to 4" pumps. FOR FURTHER DETAILS ON THESE QUALITY PUMPS, WRITE FOR BULLETIN 963.

"Buffalo"

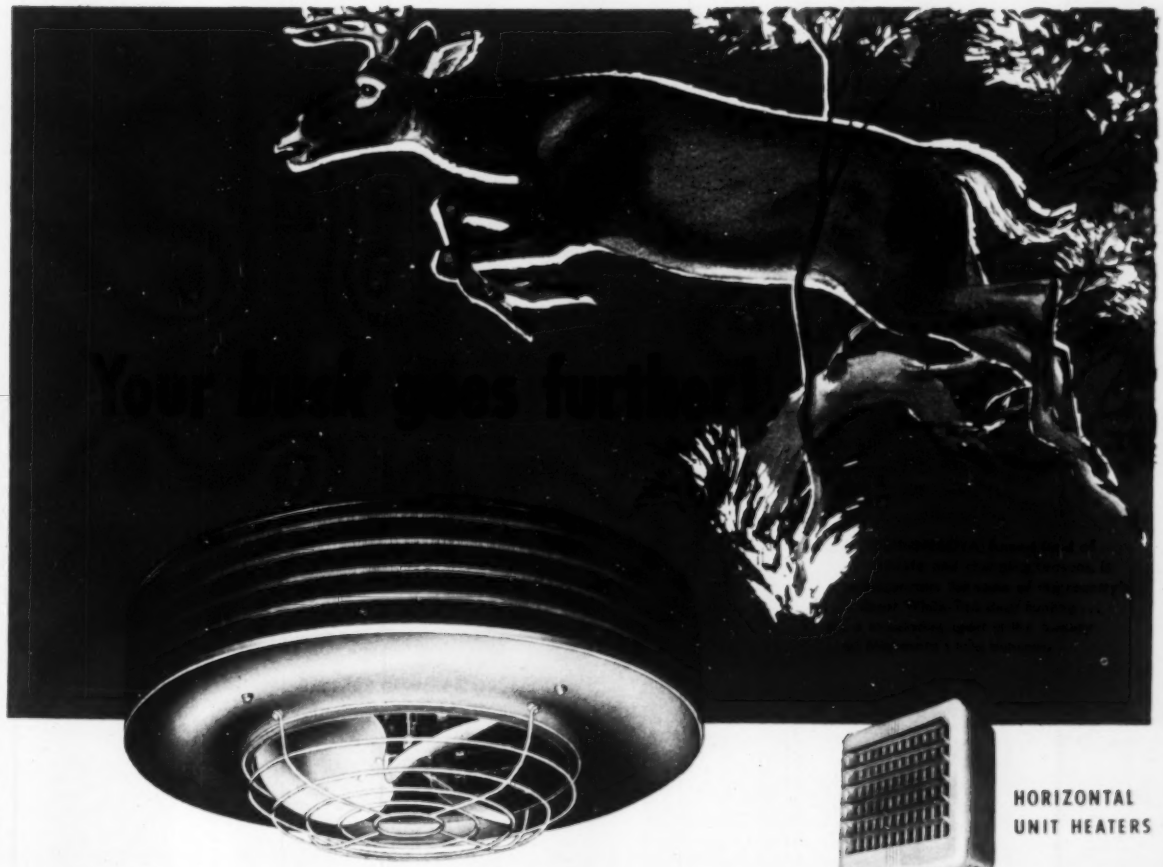
BUFFALO PUMPS, INC.

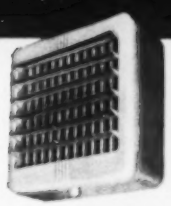
171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID





HORIZONTAL UNIT HEATERS

These unit heaters are offered for normal applications where horizontal air flow is desired. In 24 sizes with capacities ranging from 21,600 to 360,000 Btu per hour.

McQuay Down Flow Unit Heaters

Heating dollars go further when McQuay Down Flow Unit Heaters are installed. They are especially recommended for saving heat ordinarily wasted in buildings with high ceilings. These vertical unit heaters have the famous Ripple Fin Coils. Providing peak heating efficiency, they lower heating costs by circulating evenly and gently this normally stratified air.

In the McQuay line are 22 down flow units to meet your exact requirements. Capacities range from 25,400 to 500,000 Btu per hour. Four styles of directional air diffusers are available to provide any desired air distribution. Consult the McQuay representative in your city or write McQuay Inc., 1601 Broadway N.E., Minneapolis 13, Minn.

BLOWER TYPE UNIT HEATERS

For effective heat distribution over large open areas. Available in 8 sizes . . . in suspended and floor models, with one and two row coils; capacities from 20,620 to 1,632,000 Btu per hour.

McQuay INC.

HEATING • AIR CONDITIONING REFRIGERATION

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MAKE THE SEASONS COME TO YOU

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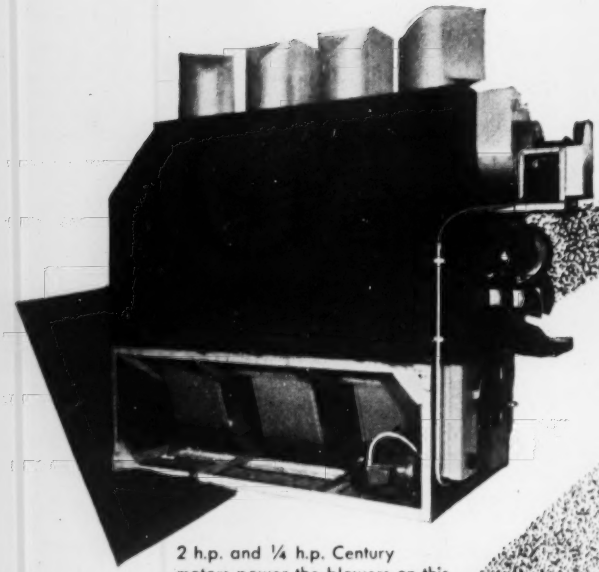
Century MOTORS

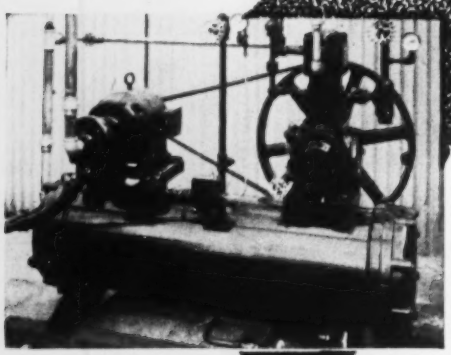
PAY OFF

IN PLEASED

CUSTOMERS



2 h.p. and ¼ h.p. Century motors power the blowers on this popular, direct-fired unit heater for commercial and industrial installation.



3 h.p. Century motor installed on an ice machine and water pump.

Even years after you've made a Century motor-powered installation you'll continue to win praise from your customers for its quiet running and efficient operation.

Leading manufacturers of heating, ventilating and air conditioning equipment choose Century motors to bring out the best performance in their products. The wide range of Century motor sizes and types enables them to select exactly the right motor design and torque characteristics to do the job best.

For help with your motor problems—replacement or new applications—consult the Century Branch Office nearest you, or conveniently located Century distributor. A nationwide network of Century Service Stations is always at your service to help you keep your customers happy.

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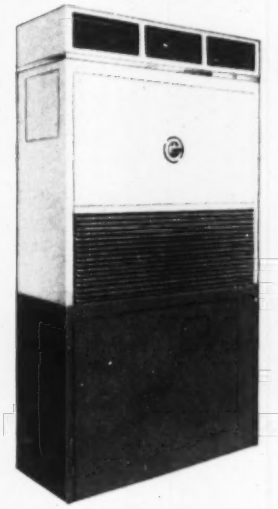
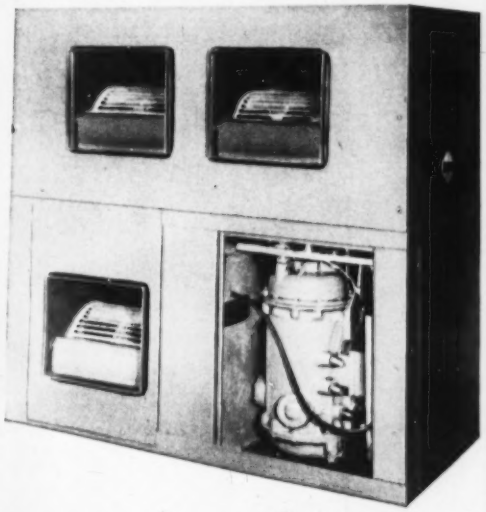


WATER COOLED
"Packaged" Air
Conditioner

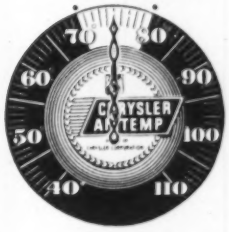


AIR COOLED
"Packaged" Air
Conditioner

make Chrysler Airtemp easier to sell!

Guaranteed by Good Housekeeping

Comfort Zone



Bonderite — Protected by — Quality Corrosion Resistant

When the air conditioners you sell are protected by Bonderite, you have a feature that can be demon-..rated quickly and easily to prospects.

Bonderite protects and preserves paint finishes in 3 important ways:

1. Anchors paint to metal
2. Resists corrosion
3. Protects paint around accidental breaks

The Bonderite process at Airtemp consists of 6 separate operations. The equipment alone costs many thousands of dollars. But—it makes a better product—it is a feature you can demonstrate—and you pay no premium for it.

Send for a free sample, so you can prove to yourself that Bonderite makes Chrysler Airtemp easier to sell.

Chrysler Airtemp

HEATING • AIR CONDITIONING
FOR HOME, BUSINESS, INDUSTRY

AIRTEMP DIVISION OF CHRYSLER CORPORATION
DAYTON 1, OHIO

Airtemp Division of Chrysler Corporation HP&AC-9-53
P.O. Box 1037, Dayton 1, Ohio

I would like to know more about the Chrysler Airtemp's franchise.

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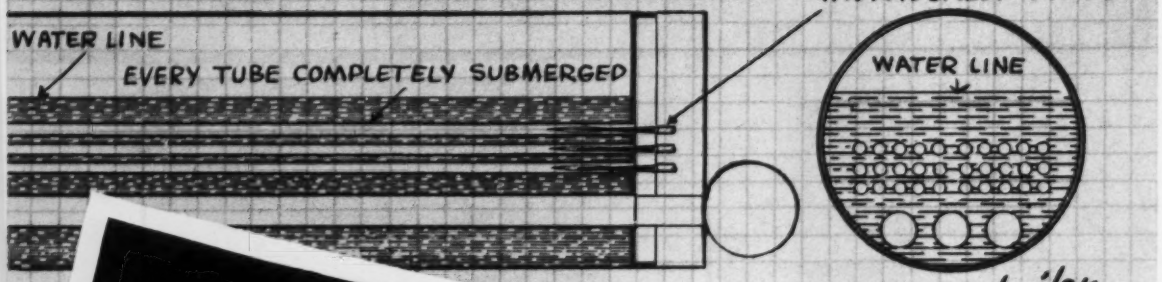
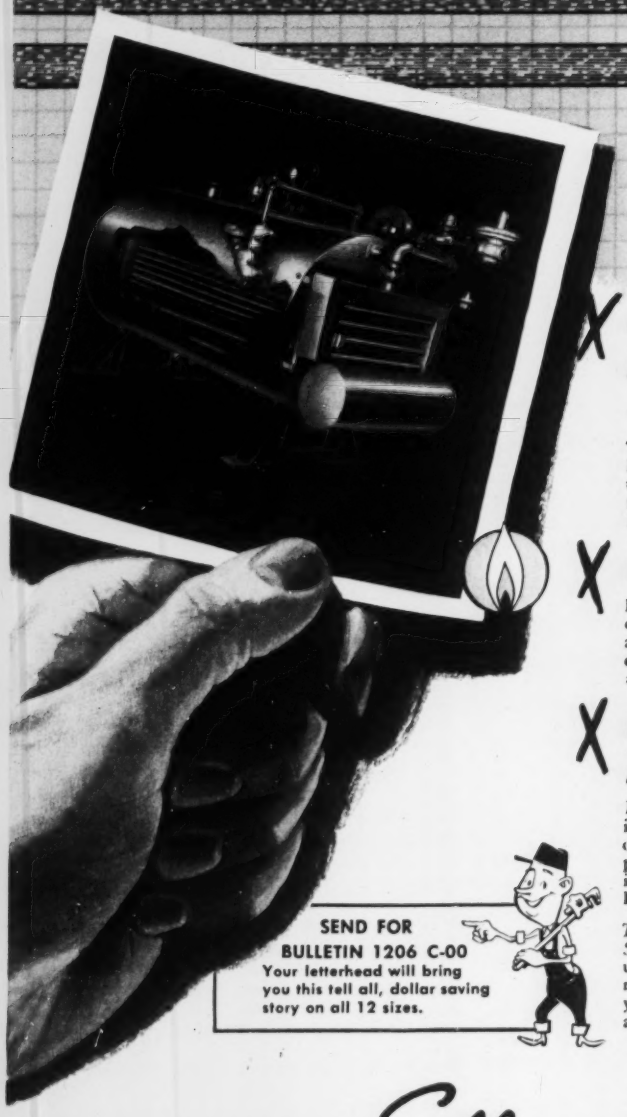
when you buy a steam boiler . . . be sure to look at the picture of a Sellers Immersion Boiler



There's no other boiler like a Sellers—



every square foot of heating surface is water backed— —100% effective!

The long, individually gas fired tubes in the Sellers Immersion Boiler are all completely submerged nearer the water level—and over the return tubes! Heat is therefore uniformly distributed through them—and directly into the water—no where else!

there's no scale problem!

In immersion heating, the needed long tubes expand and contract sufficiently on intermittent firing to crack loose any hard scale that forms on the tubes. This practically eliminates the scale problem, makes maintenance simpler and increases the boiler's efficiency.

the average flue gas travel is 15 feet!

Maximum, almost complete utilization of the exhaust heat is assured with a Sellers Immersion Boiler. This is a result of Sellers exclusive design—with the firing tubes completely submerged and *located over the return tubes*, there is a long, slow flue gas travel—an average of 15 feet! Heat can only go into the water.

There's no other steam boiler like a Sellers Immersion Steam Boiler. Its simple design gives you a package boiler unit with many other outstanding features. Minimum maintenance and maximum efficiency combine to give you years of remarkably low operating costs. Twelve sizes available!

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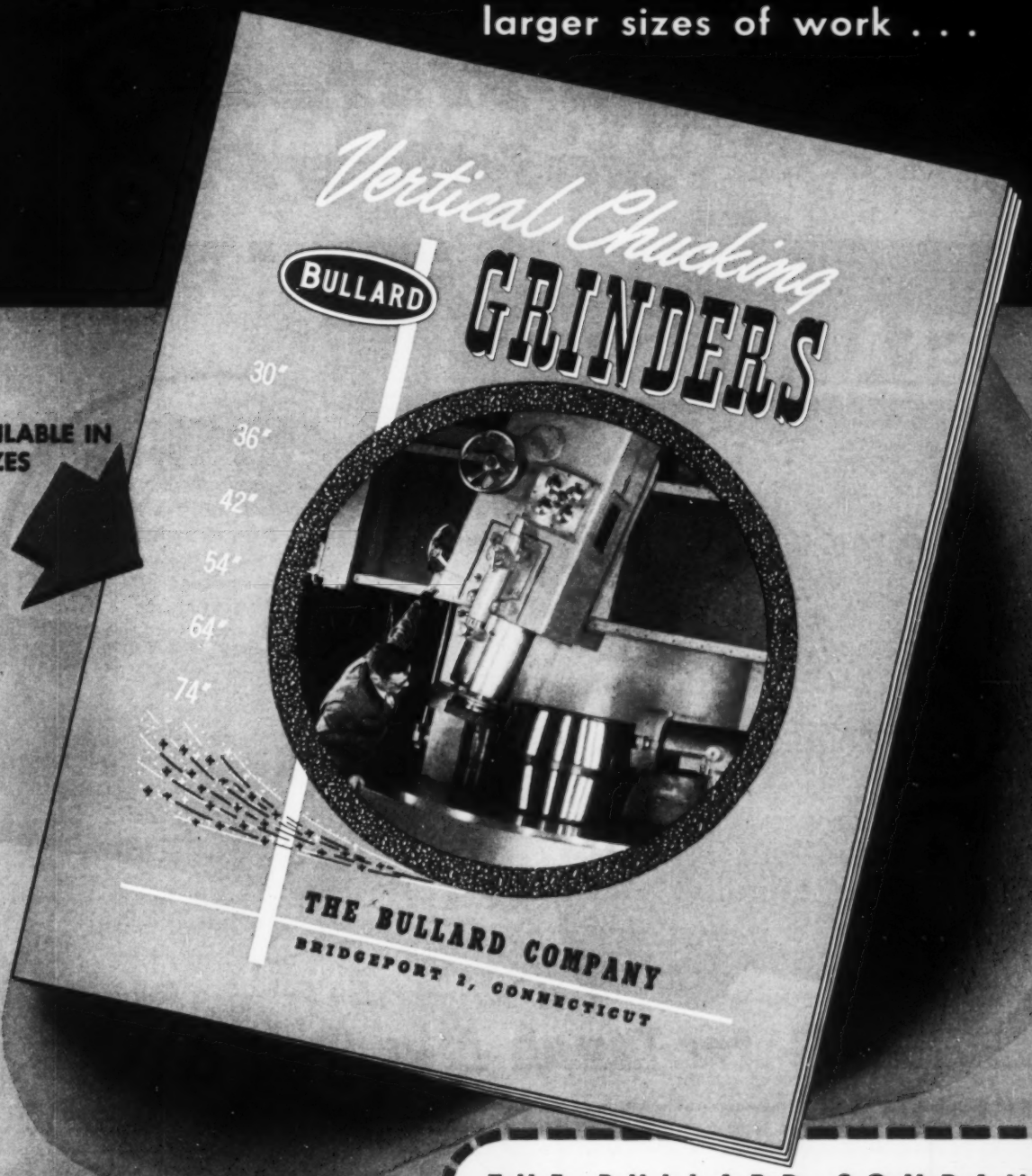
. . . for today's requirements on the larger sizes of work . . .



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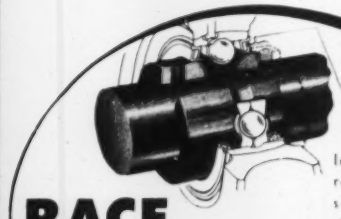
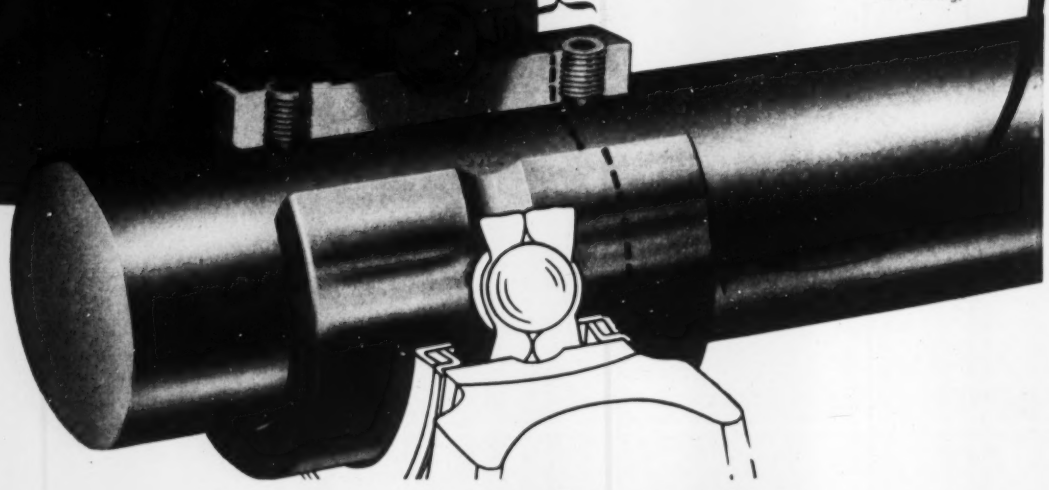


Indicates inner race ring extension affording double-locking on both sides of the bearing.



for Tough Jobs Only!

By "Tough Jobs" we mean those applications where a bearing is subject to eccentric loading—frequent reversal of motion—heavy shock loading—constant vibration—or similar extra-rugged service demands.

SEALMASTER bearings with *double extended* inner race give you the two-fisted locking these jobs require. Result—trouble-free performance and longer bearing life.

Here's why! The SEALMASTER bearing with double extended inner race distributes the load along a greater section of the shaft and provides positive race-to-shaft locking on *both sides* of the bearing. This combination of increased shaft support and positive double-locking on *both sides* of the bearing insures maximum rigidity at all times.

Double-locking plus SEALMASTER's other features will be important to you in designs requiring a tough, precision-made ball bearing mounted unit. Write for Bulletin No. 251 today.

SEALMASTER BEARINGS

A Division of STEPHENS-ADAMSON MFG. COMPANY

47 Ridgeway Avenue, Aurora, Illinois

Cartridge Unit

Flange Unit

Take-Up Unit

Flange-Cartridge Unit

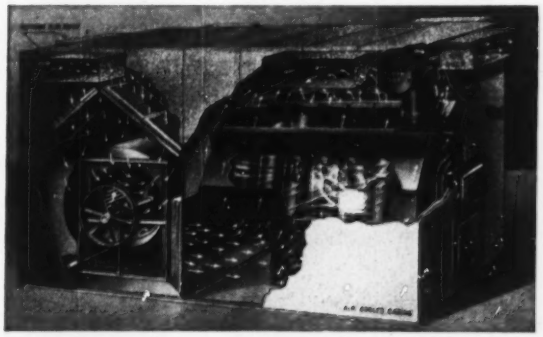
FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

WARM AIR HEATED... by Campbell

St. Paul's Evangelical Lutheran Church, Monona, Iowa. Replacement of original furnace with a Campbell Heater in 1949, has resulted in greater comfort and substantial fuel savings.

CHECK THESE ADVANTAGES

Campbell 8000 Series Heaters, in capacities from 725,000 to 3,000,000 BTUs, are ideally suited for churches and other large public buildings. Campbell Heaters are compact; easy to install; operate very quietly; are surprisingly low in cost, and amazingly economical to operate. Your inquiry will receive our prompt attention.



MANUFACTURERS' AGENTS

We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

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I am interested in your proposition for manufacturers' agents.
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CAMPBELL HEATING COMPANY
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PLUMBING AND HEATING PRODUCTS

PLUMBING
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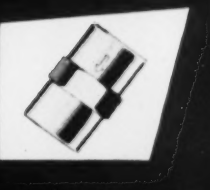

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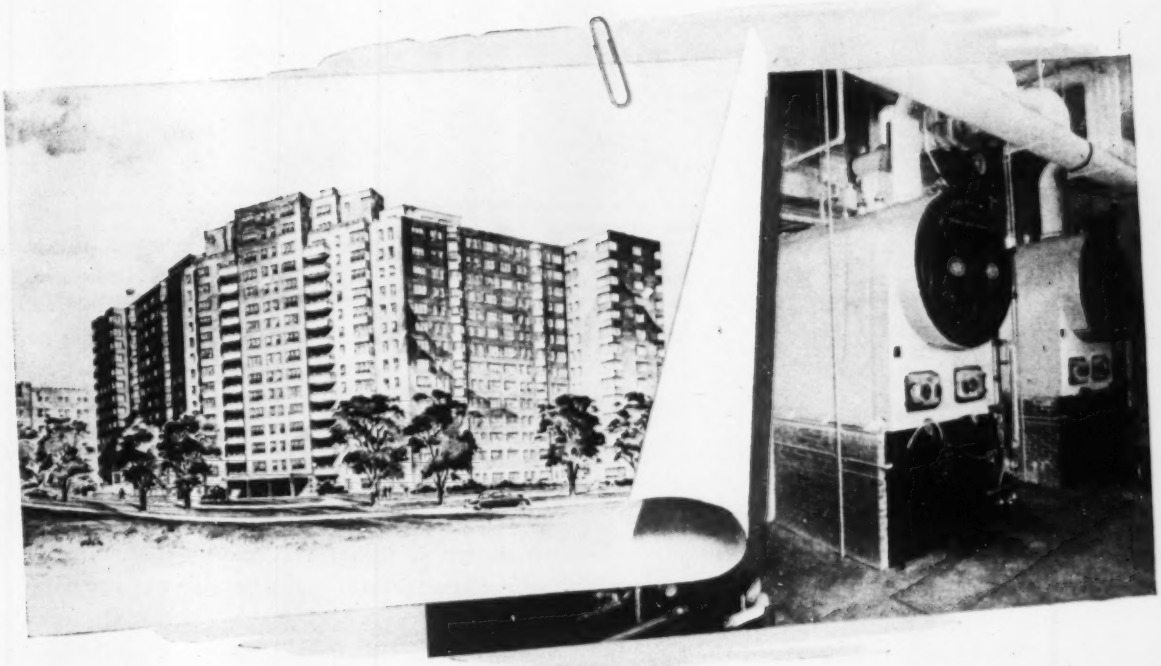
Behind this master plan for comfort . . .



PACIFIC BOILERS with JET-ACTION circulation!

Baltimore's Broadview (drawing shown above), with 465 apartments and four penthouses, is unequaled for luxury and convenience. Tenants are provided with catering services, public dining rooms, private garages, special entertainment suites, efficiency apartments for week-end guests.

To supply luxury heating comfort *plus* top economy, Broadview planners* chose Pacific Boilers with Jet-action Circulation:

Because of the special design of Pacific Circulating Connections which join water leg and heating tubes, hot water and steam from the water leg are given a jet-like increase in speed. This high-speed stream is trained directly on the heating tubes. Insulating steam bubbles on the tubes are swept into motion, *kept* in motion.

The result of this continuous turbulence is maximum heat transfer. Broadview owners get immediate response when changes in building temperature are desired, more efficient use of fuel.

Why not take a tip from Broadview planners and see how Jet-action Circulation can benefit *your* installations? Your local Pacific representative is ready with complete information on Pacific Boilers for every use. Call him today!

*Architects: Palmer, Fisher, Williams & Nes; Mechanical Engineers: Egli & Gompf; General Contractor: John K. Ruff, Inc.; Mechanical Contractors: H. E. Crook Co., Inc.

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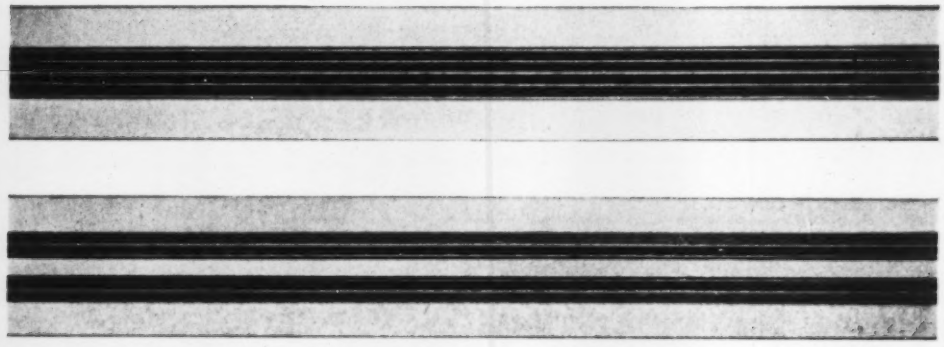
provides unlimited continuous air distribution



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AIR

AIR DIFFUSERS • FILTERS

ANOTHER AGITAIR FIRST!

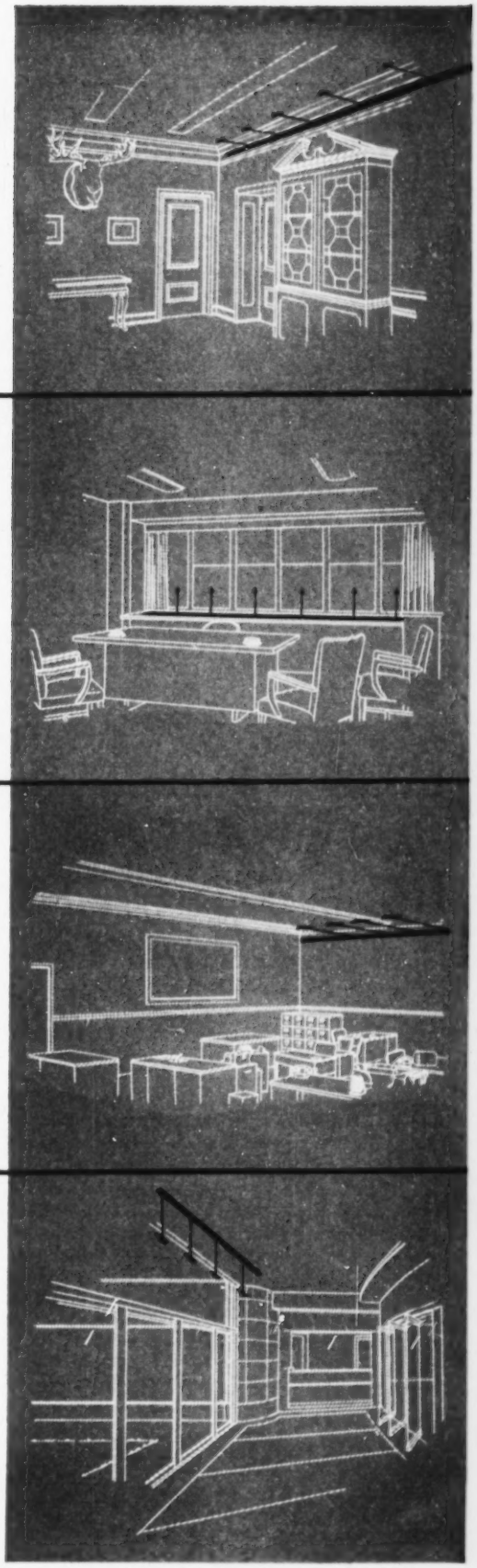
Unlike grilles, air outlet slots and side wall diffusers, AGITAIR STRIPLINE Diffusers discharge an unlimited, unvaried blanket of air over a predetermined area regardless of length of duct run.

VANES MAKE THE DIFFERENCE

Stripline's built-in diffusing vanes produce extremely high turbulence and aspiration . . . achieve rapid temperature equalization with maximum allowable temperature differentials between room and supply air . . . high rates of air change . . . equal distribution of noiseless, draftless conditioned air and completely eliminate hot or cold spots in the zone of occupancy.

UNLIMITED APPLICATION VERSATILITY

AGITAIR STRIPLINE is supplied as a continuous decorative unit, or in sections, to meet any requirements of interior treatment or air flow. Ideally suited for installation in shallow lighting coves . . . window stools for air curtaining of glass windows or exposed wall areas . . . side of furred beams . . . or as continuous decorative border blanketing the entire area with noiseless, draftless air distribution.



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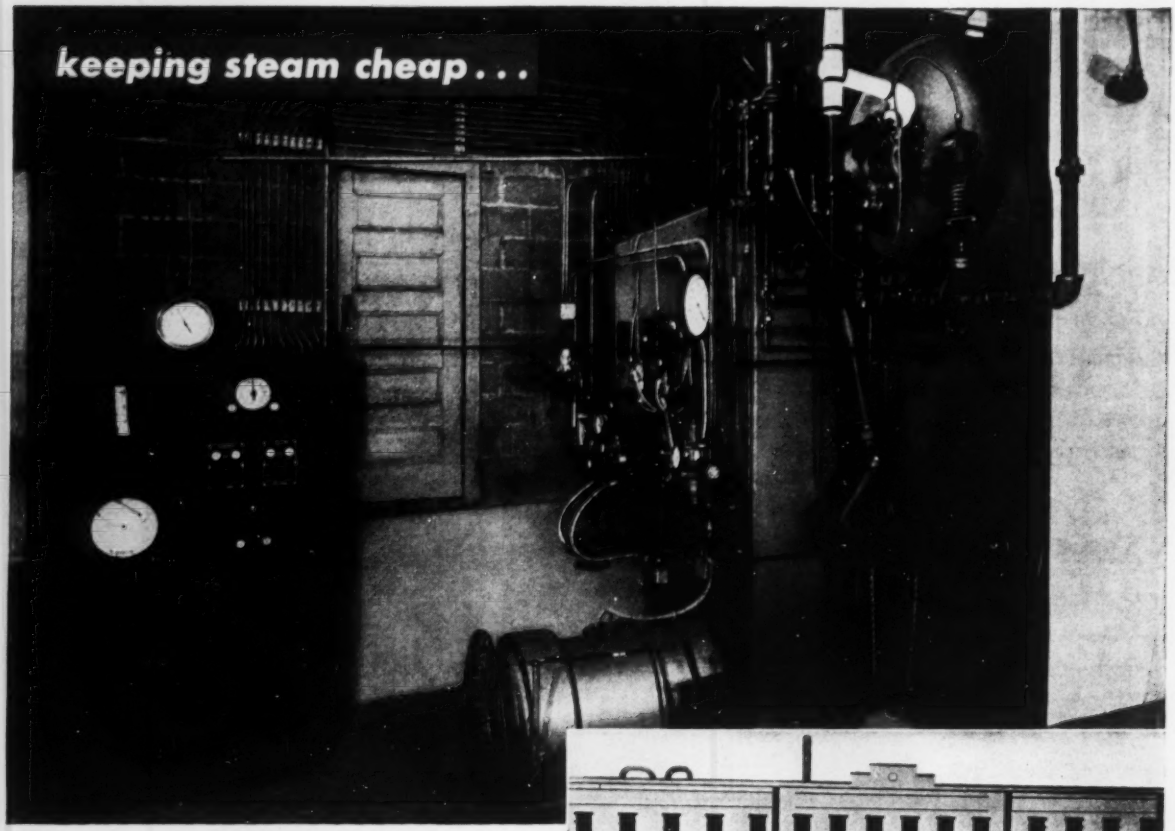
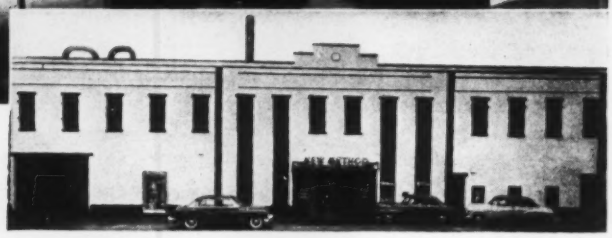
EXHAUSTERS





B&W's FIRST Integral-Furnace Boiler, Type FM

SAVING 20% ON FUEL ALONE at New Method Service

After three years of operation at the modern plant of New Method Service—a leading Staten Island laundry and dry cleaning company—the first B&W shop-assembled, Integral-Furnace Boiler, Type FM, to go into service, has proved its economy and efficiency to the complete satisfaction of the company's management and operating personnel.

This self-contained B&W oil-fired unit was installed in May, 1950, as part of a modernization program for the big New Method plant, which has been serving Staten Island residents for 31 years. With a steam capacity of 20,000 lb per hr at a pressure of 135 psi, the FM Boiler supplies steam for both heat and processing requirements of the more than 5000 garments for dry cleaning and 4000 laundry bundles handled during the average week. The B&W unit, with automatic control, supplies steam at a constant pressure, raising considerably the overall plant operating efficiency. Cleanliness—essential in a laundry—is no longer a problem, due to the elimination of smoke and ash handling. Space-saving, in and around the plant, is another plus-factor. Outside areas formerly occupied by coal and ash piles have been put to more practical use, and boiler-room space made available by the new unit provides a maintenance shop for the entire plant. Boiler-room men report only minor maintenance since the B&W unit was put into service. Summing it up, Mr. Louis Lawch, President of New Method recently remarked, "We're very happy with our investment, the boiler runs like a charm."

Since the debut of B&W's Integral-Furnace Boiler, Type FM, at New Method, additional units of this type, placed in service or on order, have a total steam capacity exceeding 6½ million lb per hr. This versatile B&W boiler is available in steam capacities ranging from 2900 to 28,000 lb per hr at pressures between 15 and 235 psi, suitable for a wide variety of industrial, utility, and other applications.

BABCOCK & WILCOX
BOILER DIVISION

Write for Bulletin G-76, for an illustrated, detailed description of the many other cost-saving features of this unique unit, The Babcock & Wilcox Company, Boiler Division, 161 E. 42nd St., New York 17, N. Y.

G-603

THE EDITORS' PAGES

Big office building in New York, famous hotel in Chicago, Philadelphia's convention hall, royal palaces abroad — all announce air conditioning . . . . One "Quote" item this month recalls a short article on the weather published in last May's HPAC . . . . Robert W. Roose joins HPAC's editorial staff

Plan Air Conditioning for Philadelphia Hall

AN ENGINEERING report recommending installation of a $1½ million air conditioning system in Philadelphia's convention hall has been submitted to the city planning commission by the Philadelphia board of trade and conventions.

Prepared by Charles S. Leopold, consulting engineer (and a member of HPAC's board of consulting and contributing editors) the report recommends a system to hold temperatures to comfortable levels on the hottest summer days, and to prevent "objectionable concentrations" of tobacco smoke at all times.

The report estimates that the system would cost approximately $1,485,000.

Competition from New York, Chicago, Detroit and other cities has made air conditioning for Philadelphia's convention hall a "must," according to the report, which says that the proposed installation should make the city a natural choice for the major political conventions in 1956. The 1952 conventions were held in the newly air conditioned International Amphitheater, Chicago, described in the July 1952 HPAC.

The report recommends air conditioning the main arena, which seats 15,000; the exhibition hall directly below the arena, with a capacity of more than 2000; the ballroom, seating about 1000, the restaurant, which seats about 700; and eight committee rooms.

Mr. Leopold emphasized that the recommended air conditioning would be a year 'round facility and would include control of tobacco smoke as well as lowering of indoor temperatures. His proposal included a plan for reducing smoke concentrations by means of electrostatic filtration.

"To reduce smoke by outdoor air alone", the report says, "would require excessive quantities of refrigeration in the summer and steam in winter, with a consequent higher first cost and operating cost."

"Smoke control", according to the report, "should prove of great importance in popularizing the use of the arena for sporting events."

The report estimates that four months would be required to complete plans for the system and that actual installation would require eight months.

The plan has been approved by the city planning commission, but several months will elapse before the budget is adopted by the city council.

50 Story New York Building Installs Air Conditioning

THE IRVING TRUST CO. announced last month award of the contract for installation of one of the largest air conditioning systems ever built into an existing building in the New York area. It will be installed in the 50 story Irving Trust building at 1 Wall St. Scheduled for use in the summer of 1954, the 1500 ton system will serve all floors.

Existing ventilating facilities will be adapted wherever possible. In addition, cold water risers will be introduced from top to bottom of the building and a supplementary peripheral cooling system built into the exterior walls of the structure. A three-story cooling tower, harmonizing with the existing building facade, will be erected on the roof.

Turner Construction Co. is the general contractor; the architects are Voorhees, Walker, Foley & Smith; and Meyer, Strong & Jones are the engineers.

Leading Chicago Hotel To Air Condition

THE ENTIRE DRAKE hotel, Chicago, is to be air conditioned, it was announced last month, the work to be done during slack seasons over the next three or four years. Guests accustomed to air conditioning in other parts of the country demand air conditioned rooms, says the management. The Drake feels that air conditioning is necessary to maintain its share of business.

The first group of 96 rooms is to be air conditioned for occupancy next summer. Two 50 ton refrigeration machines in the basement will chill water to be circulated to room units in the closets. Ultimately, there will be 14 compressors for the hotel's 670 rooms, according to present plans.

The Drake has at present some 30 window air conditioners for use during summer months.

Royalty Goes for Air Conditioning, Too

EMPEROR HIROHITO'S living quarters in the Japanese imperial palace in Tokyo are to be air conditioned, Carrier Corp. has announced.

A year 'round, duct type system will heat the 17-room quarters in winter and provide a constant flow of cooled, filtered and dehumidified air in summer. Much of the equipment for the system will be made in Japan, but the 30 hp compressor will be imported from the United States.

Air conditioning equipment cost-

"Quote"

"Of all the divisions of our business which have unusual growth possibilities, air conditioning seems to us to offer the greatest field for expansion today. We believe that air conditioning may give us a larger sales volume in a few years than any other division of our 113 year old business. It is a field in which we have had a great deal of experience."

— E. J. Schwanhausser, Executive Vice President, Worthington Corp., at a dinner marking acquisition of a tract at Decatur, Ala., for a new $3½ million plant for the manufacture of air conditioning equipment

ing approximately $150,000 is being installed in royal and government quarters in Riyadh, the capital of Saudi Arabia, it has been announced by the Westinghouse Electric International Co.

Royal guests at Badia palace, home of Crown Prince Saud, will be able to relax in comfort in this land where temperatures often reach 130 F in summer. A central type air conditioning system with a total capacity of 120 tons will condition the air in 29 guest rooms, one large dining hall and a reception hall at the palace.

A similar system is being installed at Murrabah palace, the home of Prince Talal, which will service the palace plus five guest apartments.

Installations in five new houses and one office wing are also being made for Sheik Suliman, minister of finance of Saudi Arabia. Equipment in these buildings will be of the forced air circulation type and will range from 15 tons to 30 tons capacity.

In all buildings, units will be used not only for cooling in summer but also for heating in winter, for temperatures often go below freezing on winter nights.

R. W. Roose Joins HPAC's Staff

ROBERT W. ROOSE joins Heating, Piping & Air Conditioning's staff this month as HPAC's editor. Until resigning to accept his new duties, he was research assistant professor of mechanical engineering at the University of Illinois, where he has been active for some years in studies on the fundamentals and practical

ROBERT W. ROOSE, who joins HPAC's editorial staff this month

applications of heating and air conditioning.

C. M. Burnam, Jr. — on HPAC's staff for over 24 years — continues as editorial director.

After graduating in mechanical engineering in 1940 from the University of Illinois, Mr. Roose was in the industrial engineering department of a large plant, until he was called into service as a reserve officer. He was an ordnance officer with the Air Force both in the United States and abroad. He was then assigned to the command and general staff school at Ft. Leavenworth.

After receiving his separation papers, with the rank of major, he took advanced work at the university — specializing in heating and air conditioning — and was awarded a master's degree.

Mr. and Mrs. Roose and their two sons have moved from Champaign to La Grange, a suburb of Chicago.

Chamber of Commerce Hails Air Conditioning

THE CHAMBER OF Commerce of the United States regards "the upsurge of the air conditioning industry" as an ideal example of the soundness of its current program for expansion of jobs, markets and production.

"It is the age-old story of America," says the chamber. "Once, the manufacture of wagons and carriages constituted a major industry. Even the making of buggy whips was of solid importance. But when technological advances made these things only minor in consequence, new industries, employing many more men and pouring new blood into the economic lifestream, came along to supplant them.

"The prophets of doom can look at the air conditioning industry and perhaps they will learn why America became industrially great — and stayed that way," the chamber said last month.

Air Conditioning Sales Set New Records

NET SALES FOR the Trane Co., manufacturer of air conditioning, heating and ventilating equipment, and its Canadian subsidiary, during the six months ended June 30 were $20,502,158, compared with $21,417,645 for the same period in 1952, D. C. Minard, president, has reported.

Net sales for the second quarter were $10,663,939, an increase of 7 percent over the same period in 1952. Both new orders received and shipments were well above those for the second quarter of 1952, Mr. Minard said, reflecting sales gains from new air conditioning, refrigeration and school heating and ventilating products.

Both sales and new orders received on all air conditioning products, including new lines of self-contained units and factory assembled water chillers, have shown substantial increases for the half year, according to Mr. Minard. While there have been moderate increases in the number of new commercial buildings, floor space and value of these buildings has greatly increased, he said. Sales of air conditioning equipment set new records for the six months ended June 30, reflecting heavier public demand for air conditioned offices, stores and banks. New products to be introduced for the 1954 cooling season will place the firm in a greatly improved competitive position with respect to the larger tonnage air conditioning market, Mr. Minard stated.

Room Units Chalk Up Big Sales Gain

MANUFACTURERS' shipments of room air conditioners for the first half of 1953 indicated an increase of 215 percent over the same period of 1952, according to the Air-Conditioning and Refrigeration Institute.

"People are buying more and more of the larger sizes, with the ¾ ton room air conditioner proving by far the most popular model," says George S. Jones, Jr., managing director of the institute.

"Quote"

"Looks Like a Hot Summer"

—This article, entitled "Looks Like a Hot Summer," was published in last May's issue of Heating, Piping & Air Conditioning.

DELIGHTED
with this new Clean Heating
after 25 years with radiators

V. I. Whitney, of Montesano, Wash., was one of the first home owners to discover that an old-fashioned radiator heating system could be transformed with Webster Baseboard Heating.

"Our house was built in 1926 and was considered one of the finer homes in this area," Mr. Whitney says. "We had a hot water heating system with an automatic oil burner and large cast iron radiators. There was a radiator in front of each of the beautiful windows in our large, 34 x 17 ft. living room. It was never possible to have the pretty drapes and lovely carpeting which so many modern homes use.

"We are delighted with this new installation. We have the beautiful effect of full length drapes. Carpeting goes right up to the baseboard. We can place our furniture any place in the room we like. The comfort and satisfaction which we derive from this new method of heating, merely by replacing the radiators and making no other change in our heating, has been remarkable."

V. I. Whitney residence, Montesano, Wash., where Forced Hot Water Webster Baseboard Heating has replaced old-fashioned radiators. Heating Contractor: Zimmer Heating Sales and Engineering.

Webster Baseboard Heating with forced hot water can be installed in new or existing homes. Call your Webster representative or write us.

Address Dept. HP-9

WARREN WEBSTER & COMPANY
Camden 5, N. J. Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal

Webster
TRU-PERIMETER FORCED HOT WATER
BASEBOARD HEATING

How to win friends and **MAKE MONEY**

Send for Publication 272

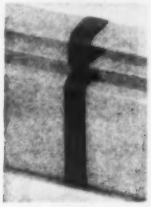
End Cap

Wall Section

Inside Corner

Damper

Outside Corner


Joint Trim

Support Bracket

NESBITT

Baseboard Radiation

When you have snapped the last front panel into place and have trimmed out with accessories, your installation of Nesbitt Baseboard Radiation is complete and you have accomplished four things: First, you have had as much fun as a kid putting together the fitted parts of a prefabricated toy. Second, with the least possible exertion and in record time you have provided a high capacity system of perimeter convector-radiation along exposed walls. Third, you have assured the full-zone comfort and contemporary beauty that makes customers friends. And fourth, you have made a quick profit.

Where other manufacturers of "baseboard" left off, Nesbitt began to make a really effective space heater with four square feet of radiation per lineal foot of corrugated fin element—adequate for one-wall performance in most rooms—and housed in a beautiful slim enclosure. Nesbitt tooled a large factory area to produce this product at the lowest cost in standard nominal lengths of four, six and eight feet—with every labor-saving provision and needed accessory—for you!

All leading makes of BASEBOARD have *something*—but *something* is not enough when NESBITT gives you *everything*!

MADE BY JOHN J. NESBITT, INC., PHILADELPHIA 36, PA. • SOLD EXCLUSIVELY THROUGH PLUMBING AND HEATING WHOLESALERS

"OPEN FOR DISCUSSION"

WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

A. NUTTING, R. F. LOGSDON —

"We Want To Answer Comments on Filter Code"

WE WOULD LIKE to comment on each of the chief objections to the Air Filter Institute's new code for testing air filters raised by Messrs. Farr, Landgraf and Van Orman, and published in the July and August issues.

MR. FARR'S CHIEF OBJECTIONS:

A) *That the code does not quantitatively present filter performance on known particle sizes of dirt.*

There can be no argument regarding the desirability of obtaining filter performance values for various particle sizes of dust. The same applies equally to various particle shapes, density, electrical charge characteristics, etc. But there also can be no argument regarding the urgent need of a common yardstick for measuring the performance of unit viscous and dry type filters. The AFI code meets the latter urgent need in a very direct and practical manner, whereas there does not exist today a single practical procedure for evaluating performance on the basis of particle size, shape or density. The DOP smoke test procedure, developed for testing of gas masks, is a step in that direction but is by no means practical for it is expensive, produces liquid droplets (charged), and up to now has not been developed beyond the approximate 0.3 micron size range.

Another suggested procedure is to feed classified dust. Our own laboratory has worked on this for years, investigating and improving the various types of classifying equipment, but has been unable as yet to produce sufficiently clean fractions. A sample of Arizona road dust — fine, from an outside source, classified to represent a 5 to 10 micron fraction, was submitted to a commercial laboratory for particle size analysis. The analysis showed only 50 percent by weight to be within the specified range. In our opinion, this dust is not well classified.

We strongly urge that work be continued on methods to test filters by particle size, shape and density, but recognize that a suitable practical method is by no means at hand nor on the horizon. In any event, it is unlikely that a classified dust or other particles generated for particle size efficiency determinations could be used also for dust holding capacity tests. The latter must be considered as an equally important factor to efficiency in air filter performance. The AFI test code provides the three essential factors necessary for judging comparative air filter performance: (a) resistance to air flow; (b) efficiency, average and at all stages during loading; and (c) dust holding capacity.

B) *That the absolute filter is less than 90 percent efficient on a "classified" 0.5 micron dust.*

First, this point is not pertinent as the absolute filter is required to have an efficiency of no less than 99 percent on the test dust specified. The 0.5 micron dust mentioned by Mr. Farr is not specified; nevertheless, for the sake of accuracy we wish to take issue with the efficiency value stated. We do not know the particle size distribution of the 0.5 micron dust mentioned but might reasonably assume the median size to be in the order of 2.5 microns. A. D. Little (ALI-23, Report No. 8, February 28, 1950) reported efficiency by count on the specified material of 91.3 percent on atmospheric dust having a particle size range from 0.2 to 1.0 micron with most particles between 0.3 and 0.5 microns.

There is a wide discrepancy in the two values, which may be the result of incorrect identification of the glass fiber material tested by Mr. Farr. Materials specified as "B" fibers and "A" fibers have much the same appearance as the "AA" material specified in the code, but cleaning efficiency is less than that of the "AA" mat.

MR. LANDGRAF'S CHIEF OBJECTIONS:

A) *Test dust is not characteristic of atmospheric dust, particle size not stated, and method unsuitable for field testing.*

There is no standard for atmospheric dust. We all know that dust varies widely as to chemical makeup, concentration, particle size, etc., with both time and location. It certainly is not practical to determine efficiency and dust holding capacity for every location under every dust condition. The AFI method is certainly not intended for field use nor is any method reliable for field use in evaluating comparative performance of air filters of the type covered by Section I of the code. The dust conditions vary too widely to set any standards.

Discoloration tests are generally applicable for field evaluation of those filters effective in removing discoloring types of particles, as such discoloring particles are virtually all under 1 micron and therefore present a degree of uniformity. Use of such a method on the ordinary mechanical type filter, however, is ridiculous. In R. S. Dill's early work (A Test Method for Air Filters, ASHVE Transactions, Vol. 44, 1938, page 379) he recognizes and states that efficiencies were uniformly low and difficult to evaluate. There is no question about this. A good dry type filter may show up clearly better than a run-of-the-mill viscous impingement unit but it is impossible to separate the latter from superior and inferior types by discoloration tests on atmosphere.

The filters covered by Section I of the AFI code are not intended to be effective in removing discoloring particulate — indeed, most filters are not purchased for this purpose. Their chief application is the protection of equipment and removal of the type of dust that settles on furnishings and equipment. There is no logic whatever in testing such units by discoloration means. Furthermore, no means are suggested for life or dust holding capacity tests when offering the discoloration procedure with atmospheric dust.

B) *Absorption of moisture by absolute filter; test accuracy no more than ± 5 percent.*

Data was presented that showed no weight gain or loss of the absolute filter beyond 0.3 grams, under various conditions of load, with air flow, and at rest overnight. The 0.3 grams was the maximum change encountered. The minimum amount of dust that may be fed for an efficiency determination is 10 grams. The maximum error then would be (0.3/10), or three percentage points. In practice, the error is less as dust fed in practically all cases is higher, depending on air volume (30 grams per hr for 800 cfm filter), and the absolute filter is used for several determinations resulting in compensation of weighing errors, if any.

C) *High efficiency expected with any kind of filter.*

One of the primary aims in developing the code was that it should show a clear and unmistakable difference between good and poor filters. Efficiency spreads for commercially available filters falling in the category covered by Section I of the code have been observed in the order of 50 to 90 percent.

MR. VAN ORMAN'S CHIEF OBJECTIONS:

A) *That the carbon in the dust tends to adhere to the particles of Arizona road dust, making the latter more easily captured.*

Opinions abound regarding the effect of carbon in dust mixtures. The fact is that the K-1 carbon tends to produce lower arrestance values. The following table is based on test data rather than opinions:

Arrestance of clean filter (Average of 4 runs)	*Description of test dust*
60.7	74% Arizona road dust-fine 26% K-1 carbon black
75.2	Arizona road dust-fine
66.1	AFI dust (Arizona road dust-fine 72% (K-1 carbon black .....25% (No. 7 cotton linters 3%

These tests were made on the same viscous impingement filter using the same equipment and aspirating pressure. Another test made at 1200 cfm on a different type of impingement filter gave an efficiency of 80.5 percent on Arizona road dust — fine and 72.8 on the AFI mixture. Certainly in these cases the carbon is not all riding on the lint, nor on the Arizona road dust particles.

B) *The test dust is not as rigorous as atmospheric dust.*

In most cases this is true, as it is generally accepted that over half the weight of particulate matter in the atmosphere is under 1 micron. There are many exceptions, of course, depending on time, place, meteorology, industrial activity, etc. These fine particles are mostly fumes and smoke; filters covered by Section I of the code are, for the most part, ineffective on such particles. The test code is sufficiently rigorous, however, to show wide difference in efficiency betwen good and inferior units. Observed spreads are from about 50 to 90 percent. Setting up a standard test procedure for mechanical filters on atmospheric dust is impractical, to say the least. This matter has been discussed earlier in comments on Mr. Landgraf's objections.

C) *The carbon is not representative of carbon in atmosphere.*

They are both carbon, they are both difficult to capture, they both have low bulk density, and therefore tend to clog air filter passages more rapidly than the high density ash or earth type dusts. K-1 carbon was chosen on the basis of its reproducibility and non-overloading characteristics. These are explained by F. B. Rowley and R. C. Jordan in their paper, Overloading of Viscous Air Filters During Accelerated Tests, ASHVE Transactions, Vol. 48, 1942, page 437. We must accept the fact that a synthetic dust mixture is necessary for testing mechanical type filters. To be acceptable, such a dust must give a sufficiently wide spread in efficiency to separate the good units from the inferior, must be reproducible, and must give realistic values for dust holding capacity. The AFI test dust fulfills these requirements.—A. NUTTING, Vice President and Chief Engineer, and R. F. LOGSDON, Assistant Director of Research, American Air Filter Co., Inc.

W. E. COLEMAN, H. G. FROSTICK —

"Difficult To Predict Currents Causing Corrosion"

WE WANT TO express our appreciation of the comments in the June HPAC by A. W. Tracy on our article about protecting against underground corrosion at the Fairless Works.

Mr. Tracy's views are correct, in our opinion, except that the title, "Copper Ground Rods Protect Against Corrosion", seems somewhat misleading. While it is true that copper ground rods are highly resistant to corrosion, buried copper electrically connected to steel structures creates a corrosion condition that cannot be ignored in modern plant design. The fact that the area of the copper ground rods is much smaller than the area of the buried steel is no criterion that the resulting corrosion may not be very detrimental.

Tests have shown that galvanic currents increase as the ratio of the area of buried copper to the area of the more anodic metal increases. The electrical ground rods at the Fairless Works have an area of approximately 5000 sq ft, and this is not a negligible amount when it is considered that all the buried pipe lines and lead cables are protected with an insulated coating, and that a large proportion of the building steel work is encased in concrete.

It is difficult to predict the precise point at which galvanic currents will attack a buried structure. The relatively "small" magnitude of the current can be concentrated and continuous, so that costly damage can result.

The elimination of bare copper underground is not by any means a complete cure for underground corrosion problems, but we believe it to be an important step in the overall program of underground corrosion control in industrial plants.—WILLIAM E. COLEMAN and HAROLD G. FROSTICK, United States Steel Corp.

DR. ROBERT LOBSTEIN —

Raising the Efficiency of Engineers

I READ WITH GREAT satisfaction the item in the March HPAC about the shortage of engineers. The reasons given seem very logical.

To raise the efficiency of engineers by employing them only as engineers — relieving them of paper work and other non-technical activities by giving them the help of technical assistants, draftsmen, and clerks — is as valid now as in the future. Such new freedom for engineers would unburden them of many time-consuming matters.

It would help not only industry and the engineer himself but would also raise the level of our engineering schools and the whole engineering profession.—DR. ROBERT LOBSTEIN, M.E., Ch.E., P.E.

ANOTHER CASE OF

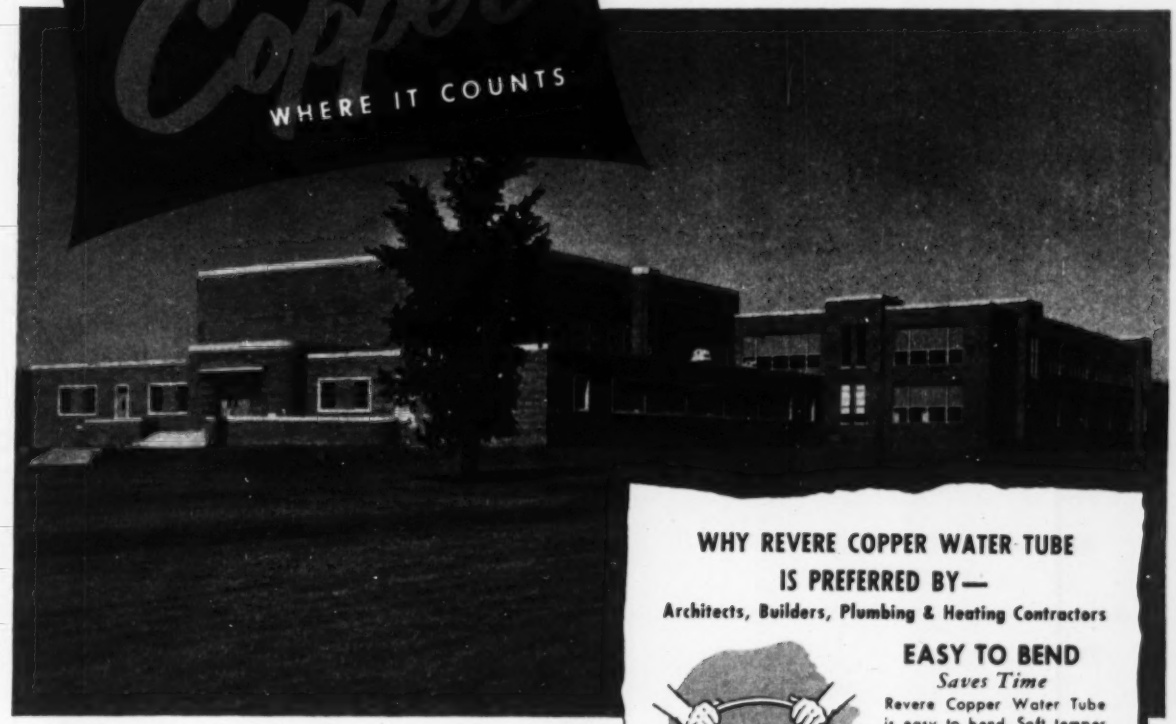
Copper

WHERE IT COUNTS

LAUREL STREET SCHOOL

Rome, New York

STARRETT & VAN VLECK and REGINALD E. MARSH: Associate Architects, New York City; F. D. RICH COMPANY: General Contractor, Stamford, Conn.; HAROLD G. RICE: Supervising Engineer, Rome, New York; A. J. ECKERT CO.: Plumbing Contractor, Albany, New York; H. J. BRANDELES CORP.: Heating Contractor, Utica, New York.



In public buildings such as this, that are built to last, again and again you'll find that in the vital spots copper invariably gets the call over other metals.

There are valid reasons for this. Not another metal or alloy has all of the desirable construction characteristics of copper.

Just check the features of Revere Copper Water Tube outlined in the panel at the right. No wonder there was no hesitation or question when nearly 4 miles of Revere Copper Water Tube was written into the Laurel Street School specifications for plumbing, heating, refrigeration and temperature control lines. And contractors prefer Revere Copper Water Tube because it is not only readily handled and worked, but they know they can trust copper to guard their reputation for quality work. Sizes of tube used in the Laurel Street School ranged from ½ inch to 4 inches.

Keep out of trouble with copper. Specify Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, air conditioning and processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

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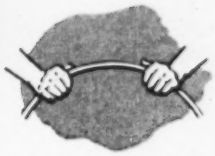
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

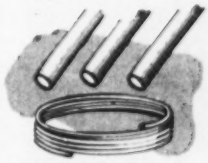
Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS

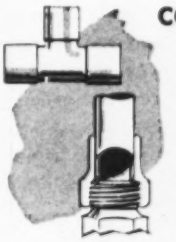
Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.



SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal



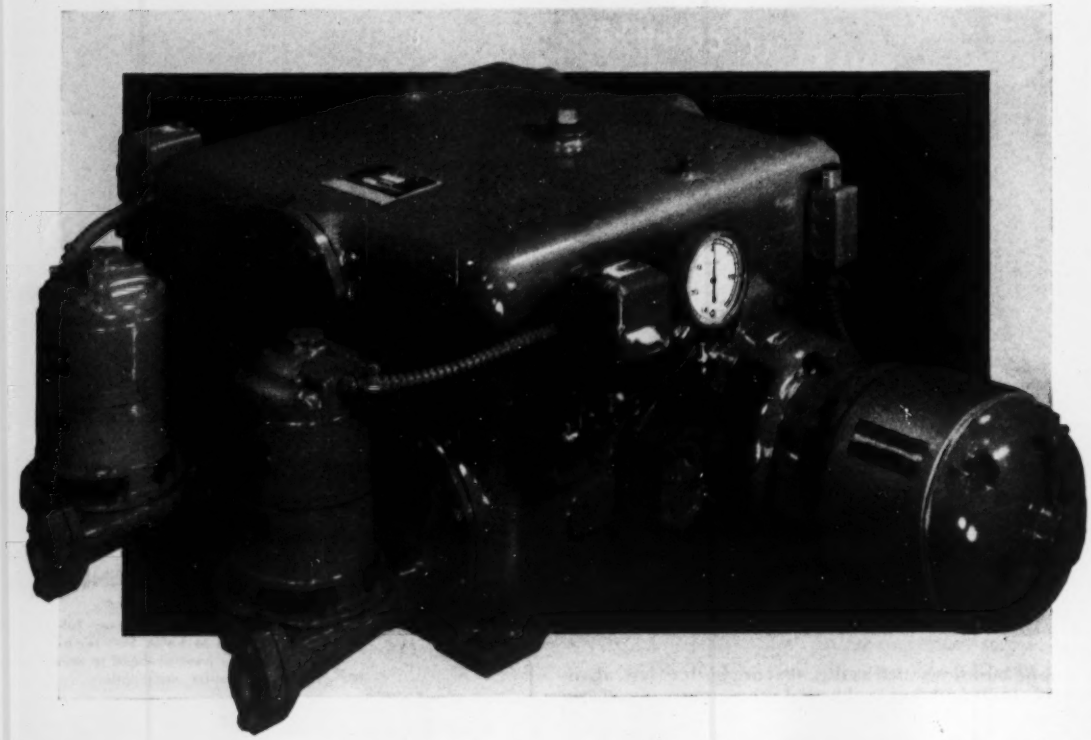
No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

ONE OF THE BRANCH SUPPLY DUCTS along the ceiling between two rows of printing presses. As each of the valves through which the air is distributed has a capacity of about 300 cfm, they are almost continuous down the run of the duct

Rand McNally Uses New Method for

Delivering Air to Press Rooms

By F. F. Stevenson

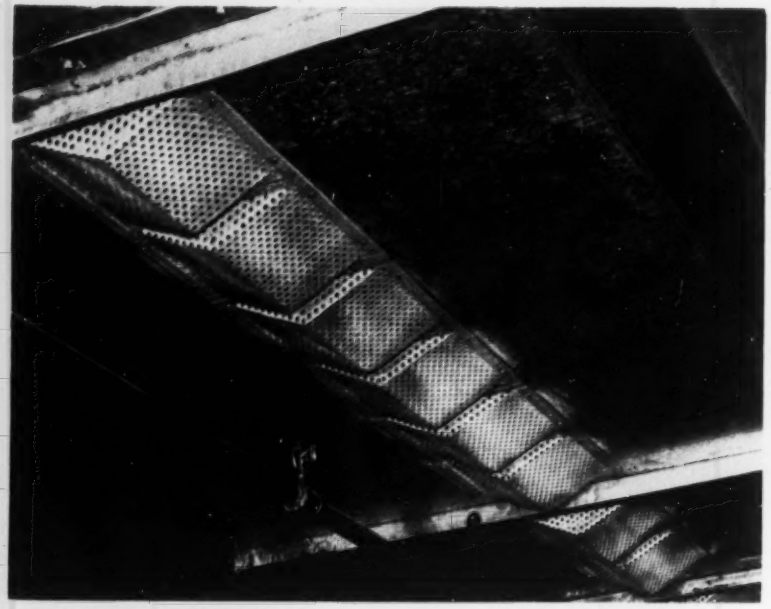
Offset printing press rooms pose critical air conditioning and ventilating problems. Here's a brand-new method that has met the situation at a world-known printing plant

WHAT IS BELIEVED to be an entirely new method of delivering conditioned air to press rooms of large printing and lithographic establishments has been installed at Rand McNally & Co.'s new plant, Skokie, Ill.

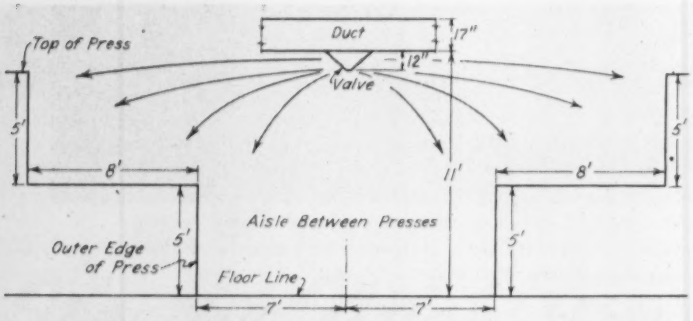
Opposing Factors

Such spaces pose many problems for the air conditioning and ventilating designer. The internal sensible cooling load is high, due principally to the large number of electric motors used plus a high lighting wattage. The latent load is also considerable, due to water sprays on

Mr. Stevenson is a design engineer who has had a wide experience in air conditioning work with several of the large engineering and architectural offices.



A CLOSE-UP VIEW of the air valves on the bottom of the duct. The same scheme should have applications in other plants and buildings where it offers opportunities to engineers and contractors correcting faulty air conditioning



THE AIR FLOW PATTERN from the valves on the bottom of the exposed duct is indicated by the directional arrows on this rough sketch. The duct is 125 ft long, runs along the ceiling over the aisle space between the two lines of printing presses

the presses and standing surfaces of water. These loads are highly concentrated at each press. To make matters worse for the designer, the rollers of the press and the paper are very sensitive to air flow. Too much air will dry the plates and spoil the paper. Moreover, the operators must work in locations where drafts, if existing, will bother them, as explained in the article on this subject on pp. 102-103 of the April HPAC.

Thus, there are opposing factors in printing plant work — the necessity for large volumes of air for cooling purposes and the susceptibility of the process to even moderate air velocities.

The Rand McNally offset press room produces the maps, guides and other multi-color printed matter which has made this company known the world over. The problem of air distribution is being met in an ingenious manner, with a method of distributing air which, to my knowledge, has never been tried before.

Rand McNally's press room is large, about 160 ft x 160 ft, with about 25,000 sq ft of floor area. There is no suspended ceiling and the roof is about 14 ft above the floor level. The roof is sprayed during warm, sunny days, which reduces the heat gain of the space considerably. The volume of the room is about 350,000 cu ft. The presses extend in two parallel lines, each about 140 ft long, with provision for a third line to consist of two or three new presses which may be added in a year or two. The internal sensible cooling load, including the presses to be added in the future, amounts to about 1,600,000 Btu per hr and the total internal load is about 1,750,000 Btu per hr.

At present, about 70,000 cfm of conditioned air is delivered to the room, with a 20 F diffusion temperature difference when the load is at the peak. The total internal load amounts to about 7000 Btu per 100 sq ft, which is the equivalent of over ½ ton of refrigeration. There is a sizable amount of storage space in the room, which has a comparatively low cooling load, and if this space were separated from the total, the internal load in the press area proper would exceed 8000 Btu per 100 sq ft.

The air change (with 70,000 cfm) amounts to more than 12 per hr, and when the additional presses are installed it will run to perhaps 15 per hr or greater. The present air change, in the area of concentrated load, runs better than 15 per hr.

Air Velocity Must Be Low

As was noted in the April article, the air velocity at the press rollers, and where the operator stands, must be low. In this case, it was set at 200 fpm or less. Before laying out the system, several arrangements were discussed. Cost — as well as performance — was a consideration.

Finally, Thomas H. Leonard (of Rand McNally) came up with the idea of using only the valves ordinarily used with the low velocity, perforated ceiling panel method of air diffusion, which substantially lowered the cost per outlet. The valves are placed on the bottom of exposed duct runs as air outlets. As each valve has a limited air capacity — about 300 cfm at maximum flow — the design required almost a continuous section of valves down the run of duct.

At first, considerable skepticism was expressed about this design. I have had considerable experience with air distribution using a perfo-

rated ceiling plate and a similar valve made up in an integral fixture, but not with the valve alone. In the press room, noise is not a factor — but the pattern of air flow and its velocity is all-important.

After checking and consultation, Mr. Leonard still was convinced that such a system would function well, and with some collaboration from the writer, a design was worked out. Three lines of ducts were installed, fed from a main on the other side of a wall running at a 90 deg angle to the supply lines. Each of the three duct lines handles approximately 20,000 cfm. The valve sections are almost continuous along the bottom of the duct, with reductions in duct size made after every five valves. An average of 65 valves is used on each duct line.

Balancing the air flow is accomplished by the manual plate damper which is integral with each valve outlet. The duct velocity is fairly high, due to the large amount of air handled. Each valve delivers about 300 cfm, which makes for a high noise level, but noise is not a critical factor in this installation. The noise emanating from the rush of air in the exposed duct run is higher than the level of the outlets. The static pressure in the duct provides the motivating force to discharge the air through the valve.

Air Flow Pattern

The ducts hug the underside of the roof as tightly as possible. Due to the depth of the duct work and the height of the presses — some of them extending 10 ft or more above the floor — the ducts are not directly above the presses but over the aisles between them. This brought up the question as to whether the pattern of air flow from the valves would be suitable for this location.

Experiments seemed to indicate that the bulk of the air would be discharged in a dropping horizontal plane rather than straight down, and this was confirmed in actual practice. Also, actual velocities at the press rollers are lower than the design values.

The bottoms of the valves are between 10 and 11 ft above the floor and in a horizontal plane are about 7 ft away from the ends of the presses and about 16 ft from the closest press roller.

THE MAIN SUPPLY DUCT feeding the three branch ducts is in the bindery along the wall between the press room and the bindery. The grille in the wall exhausts air from the conditioned press room into the unconditioned bindery

The air throw pattern is about as shown in the sketch. The throw when reaching the edge of the press is about 8 ft off the floor level, and its contour spreads out considerably in both directions. At the point where the press operator stands, the velocity of the throw is negligible. It may be noticed that the pattern resembles the flow from a narrow slot — short throw with a quick aspirating quality.

Since the system has been installed, there has been no spoilage of plates and the operators are happy.

Temperature, Humidity

The room is held at present at 78 F dry bulb and about 46 to 48 percent relative humidity. It is calculated that, with a comparatively small amount of additional air, the system will have no trouble in holding this design after two or more additional large presses are installed.

The system is designed to use about 85 percent return air, and there is no exhaust fan or economizer set-up in the plenum. Other areas in the plant are served by plenums having two fans and an economizer, but in the press room plenum the economizer was discarded "in the interest of economy" — a paradoxical statement. Some air is exfiltrated through two double service doors and some is discharged through wall grilles into the adjoining bindery room, which is not air conditioned.

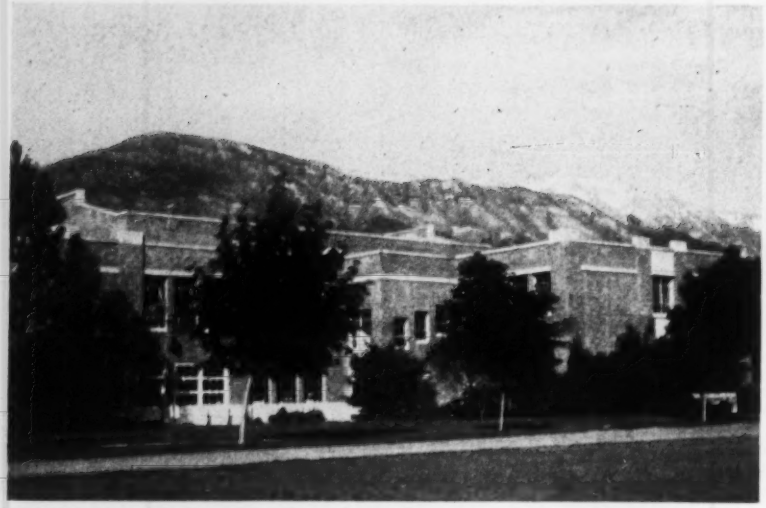
All in all, the design, though untried before, seems to be eminently successful, which tends to prove that sometimes it is well to depart from cut and dried methods and take a chance occasionally on uncharted seas.

Predicts 1 Million Room Units Next Year

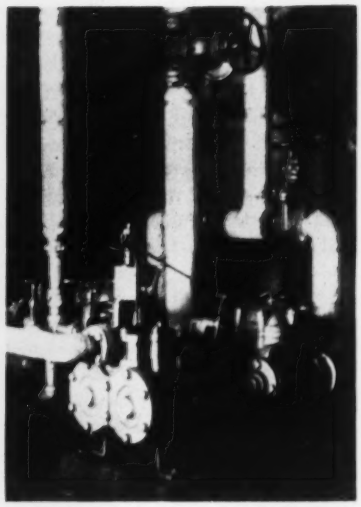
MORE THAN 700,000 room air conditioners will be sold this year, Walter H. Eichelberger, vice president, refrigeration div., Philco Corp., predicted last month. Sales in 1954 will exceed 1 million units, he said.

Mr. Eichelberger addressed the 13th annual conference of the International Association of Electrical Leagues, in session at San Francisco.

"Today, many dealers sell room air conditioners the year around, even in northern climates," he told the conference. "They emphasize that there is more to air conditioning in a room unit than just cooling. Ventilation, air filtering, circulation and exhausting stale air are desirable in January as well as July."



FOLLOWING THE MODERNIZATION at the state training school, similar installations were made at other institutions. This is the administration building at the school



TWO DUPLEX STEAM DRIVEN boiler feed pumps were installed, one of them being for standby

Heating Plants Modernized

. . . . at Utah's state buildings. Duplex steam pumps, deaerating feedwater heaters, other changes conserve steam use

By E. J. Watts
Worthington Corp.

THE DIRECT ACTING steam pump has been used for over 100 years where variable capacity operation is required, excess steam is available, or exhaust steam can be used to reduce the cost of a heating operation.

An interesting example of this latter application is found in the state training school heating plant at American Fork, Utah. A few years ago, the state embarked on a program of modernizing its central heating plants in the colleges, hospitals and training schools throughout Utah.

First to be improved under this program was the American Fork installation. The boiler plant then consisted of three horizontal fire tube boilers having a combined output of approximately 12,000 lb per hr of steam at 80 lb gage pressure, the steam being distributed through underground lines to the various buildings on the campus. All condensate from each building converged to a condensate return pumping unit in the building, where it was returned to a 400 gal vented receiver (or hot well) in the boiler room. A boiler feed pump took its suction from the hot well and supplied the boilers as required, through feedwater regulators. Essentially, then, this was a typical steam heating system, with the customary equipment.

Feedwater Heater

The modernization of this plant was to include a means of removing non-condensable gases (O_2 and CO_2) from the condensate and make-up water, with equipment sized to handle a total future load of 30,000 lb per hr of steam. Improvement in overall plant operating efficiency was a prime consideration, as was the use of equipment not requiring highly skilled operating personnel.

A 30,000 lb per hr, tray type, direct contact, deaerating feedwater heater was installed in a pent house on the roof of the boiler room directly above two 7½ x 5 x 6 fully bronze fitted duplex steam driven boiler feed pumps. One of these pumps is for standby service only. Plant practice is to operate each pump on alternate weeks. All condensate from the system is returned to the 400 gal hot well. A 5¼ x 4¾ x 5 fully bronze fitted duplex steam driven transfer pump maintains the operating level in the feedwater heater, taking its suction from the hot well and transferring condensate to the heater as required.

The transfer pump is controlled by a constant pressure governor.

When the float controlled inlet valve to the feedwater heater is in the open position, the reduction in water pressure between the transfer pump discharge and the feedwater heater actuates the governor, thus supplying the heater with condensate from the hotwell.

The boiler feed pump is controlled by an excess pressure governor. Thus, the operation of the boiler feed and transfer pumps is completely automatic, and their rate of operation is governed by the demand. The pumps operate at 5 lb gage steam back pressure and all exhaust steam is directed to the feedwater heater through an oil separator.

Fuel Is Saved

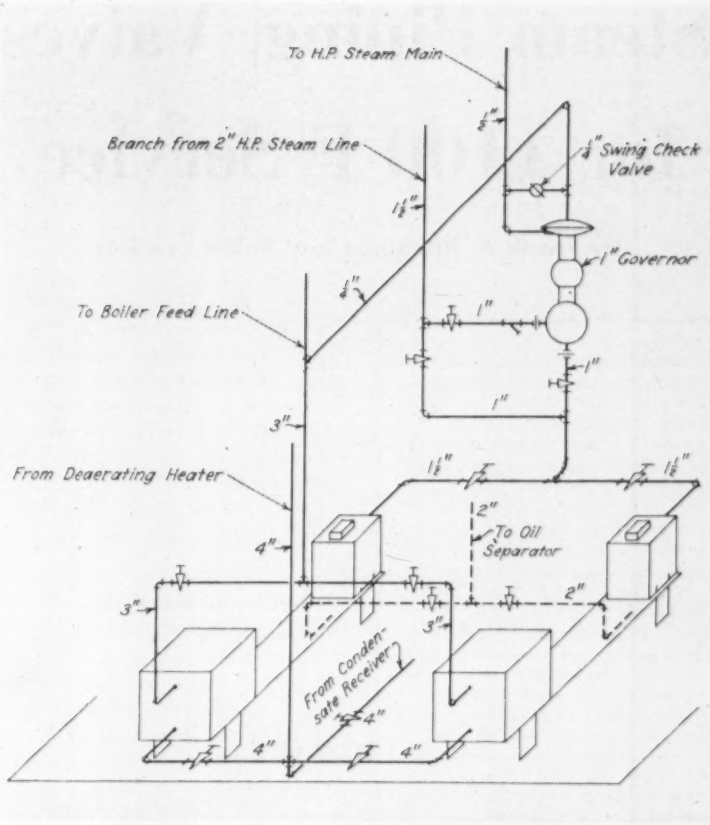
Prior to the installation of the feedwater heater, the condensate was fed to the boilers at approximately 170 F. Now, the deaerated condensate is transferred from the heater to the boilers at 220 F, and the steam required for heating and deaerating the condensate, up to 15,000 lb per hr boiler output, is furnished entirely from exhaust of the transfer and boiler feed pumps. There is a substantial saving, therefore, in fuel requirements by utilizing the exhaust steam from the pumps; prior to the installation of the deaerating heater, the exhaust steam would have been vented to the atmosphere. Above 15,000 lb per hr boiler output, additional steam is supplied the heater from the live steam main through a pressure reducing valve.

Last year, the old boilers were replaced with two new boilers having a combined output of approximately 15,000 lb per hr at 125 lb gage. A third boiler is to be installed.

The heating load has grown considerably over the past few years. As new buildings are constructed, they are heated by steam from the central plant. Several existing buildings, which formerly had their own individual heating boilers, have been connected to the central plant. Two future buildings will be heated from the steam supplied by existing distribution lines.

Other Similar Changes

Since the modernization program was undertaken at American Fork, similar changes have been made at the state agricultural college in Logan, where two 10 x 7 x 10 fully bronze fitted boiler feed pumps are in service, the branch agricultural college at Cedar City where 7½ x 5 x 6 pumps supply the boiler from a feedwater heater, and at the state hospital, Provo. In this plant, the two boiler feed pumps are 7½ x 5 x 6's and the two transfer pumps are 5¼ x 4¾ x 5's. Each of these pumps is furnished with cup type pistons.



THE BOILER FEED PUMP connections are shown in this diagrammatic sketch. The boiler feed pump is controlled by an excess pressure governor

Water Use Restrictions on the Increase

Evidence of a national trend to more and more restrictions on unlimited use of water has come to light in a recently-completed survey by Chrysler Corp.'s statistical department.

"In just four years," declared C. E. Buchholzer, president of Chrysler's Airtemp Div., "the number of communities in the country restricting unlimited water usage has doubled."

A similar survey four years ago provided the comparison below.

"Principal reasons for the regulations are inadequate water supply and sewer facilities," Mr. Buchholzer said. "Detroit is an example of this situation. Unlimited water supplies are readily available. But the city's growing industrial and residential demand for water exceeds distribution and sewer facilities. And there is little relief in sight before 1954, local officials have stated." In the west and southwest, a plain lack of water has caused stringent regulations even on normal usage.

In a way, these critical water areas are a tremendous boost to the popularity of air cooled air conditioning, he stated.

Restrictions	1953	1949
Water	47	10
Sewer	70	67
Water and sewer	36	5
Water pending	49	22
Sewer pending	3	—
Sewer and water pending*	20	—
	225	104

*Not noted in 1949 survey.

Steam Piping, Valves for 1100 F Service

By Frank A. Ritchings and Sabin Crocker

Results are available from extended research on the behavior of austenitic and ferritic steels in a steam atmosphere at 1100 F. Allowable stresses at temperatures up to 1100 F and higher have been assigned by code committees with respect to long-time strength as determined from creep and stress-to-rupture tests. Two large boiler-turbine units employing austenitic piping for 1100 F throttle steam temperature are being installed this year. Austenitic steels are definitely expensive, however, and alloying elements, particularly nickel and columbium, are in short supply.

The present paper reviews existing data and speculates on whether low alloy content ferritic steels could be made to serve the purpose. Spot comparisons are made of the relative cost of austenitic and ferritic steel pipe of equivalent carrying capacity.

[The first part of this paper was published in the August HPAC.]

BEFORE THE KOREAN "situation," it was generally conceded necessary to use austenitic steel for steam piping operating at temperatures of 1050 F or 1100 F. More recently, several stations have been built for a throttle temperature of 1050 F using ferritic-steel piping. Two 145,000 kw units installed this year by Public Service Electric and Gas Co. of New Jersey for initial steam conditions of 2350 psig, 1100 F with reheat to 1050 F have Type 347 austenitic stainless steel for the 1100 F piping because of its corrosion resistance and relatively superior creep and rupture strength with correspondingly higher *S* values, as shown in Figs. 4, 5 and 6 [published last month]. As discussed later, corrosion is not the controlling factor for steam temperatures up to 1100 F or so, inasmuch as the ferritic alloys under consideration seem to have enough chromium provided for protection against graphitization to inhibit corrosion also, 1 to 2 percent chromium probably being sufficient for both purposes.

Mr. Ritchings is Chief Mechanical Engineer, and Mr. Crocker is Mechanical Engineer, Ebasco Services Inc. Mr. Crocker is a member of HPAC's board of consulting and contributing editors. This paper was presented at the 1953 semi-annual meeting of the American Society of Mechanical Engineers held in Los Angeles.

Selection of Materials

Reasons for Favoring Low Alloy Steels: At the present time, however, there are several reasons for using ferritic-steel piping materials if and when throttle temperature are generally increased to 1100 F, among which are:

1) Cost: Pound-for-pound, austenitic steel costs in the order of four to five times what low-alloy ferritic steel does. Considered in terms of cost per foot of pipe, however, this premium is reduced considerably as discussed under "Relative Costs of Austenitic and Ferritic Pipe."

2) Conservation of strategic materials: During the present emergency the nickel and columbium or titanium components of austenitic stainless steel are in short supply and have to be conserved for essential use.

3) Corrosion: As discussed under "Corrosion in High Temperature Steam," the low-chromium ferritic steels seem sufficiently corrosion resistant to warrant their use at 1100 F.

4) Welded joints: Austenitic steels are difficult to weld without producing cracks in the deposited metal. As discussed under "Welded Joints," austenitic welds and the heat affected zones adjacent thereto lack stability of the carbides unless "stabilized" with columbium or titanium, and are more susceptible to embrittlement than ferritic welds under prolonged exposure to temperature.

Equivalent Pipe Sizes for Different Materials: The allowable stresses of the solid lines shown in Fig. 6 were derived from the properties compared in Figs. 1 to 5 inclusive and represent the considered opinion of the code committees concerning the load-carrying abilities of the steels under discussion. The dash line of Fig. 6 represents the authors' estimate of what might be a conservative *S* value for 1 percent chromium, 1 percent molybdenum, ¼ percent vanadium steel if it can be given partial credit for superior high temperature properties obtained through favorable heat treatment. These *S* values constitute a useful criterion of expected performance for alternative materials in 1100 F steam service which can be further developed through application in the new code formula for computing pipe wall thickness (14, 15).[*]

$$t_m = [PD/(2S + 2yP)] + C$$

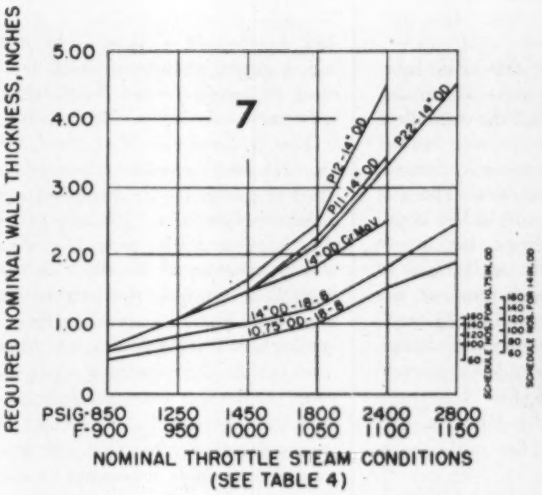
where t_m = minimum pipe wall thickness, in. (in ordering pipe, manufacturers' tolerances have to be taken into account for specifying a "nominal" thickness.); P = maximum internal service pressure at the operating metal temperature for which the *S* value is given, psig; D = outside diameter of pipe, in.; S = allowable stress due to internal pressure as given in the Code table for the respective metal temperature, psi (values for intermediate temperatures are determined by interpolation); C = Allowance for threading, mechanical strength, and/or corrosion, in. (for welded joints and pipe, of the size discussed in this paper, the value of C = 0.065; y = a coefficient having the following values:

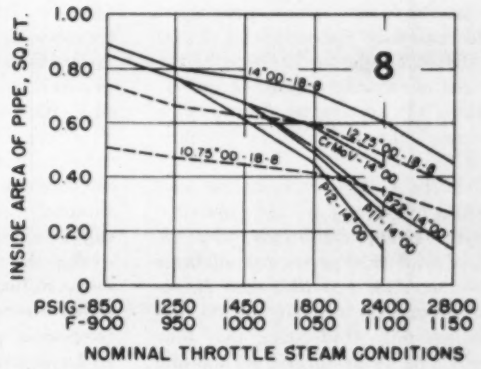
Type of steel	Metal Temperature 900F and below	950F	1000F	1050F	1100F	1150 and above
Ferritic	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic	0.4	0.4	0.4	0.4	0.5	0.7

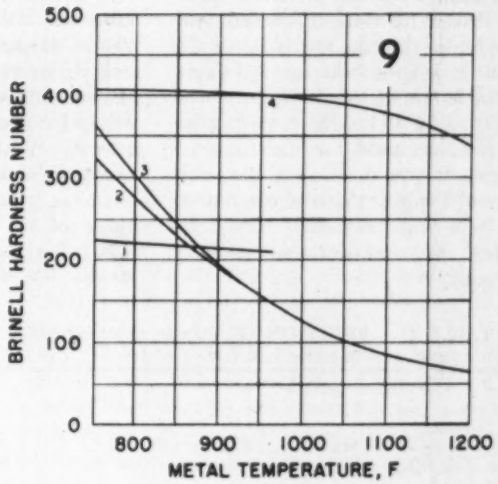
The values of y should be interpolated for intermediate temperatures.

For purposes of analysis it is convenient to assume a progression of throttle steam conditions in steps, as shown in Table 4, from 850 psig, 900 F to 2800 psig, 1150 F, the latter being the highest steam temperature at which there is much likelihood of using a ferritic steel. As previously mentioned, it is usually necessary to design steam piping for pressures and temperatures somewhat above nominal throttle conditions; in the present instance, pressures have been increased by 10 percent and temperatures by 10 F, as shown in Table 4. The assumed throttle steam conditions agree, inso-

[*]Numbers in parentheses refer to bibliography.







7 REQUIRED NOMINAL WALL thickness for alternative pipe steels at progressively higher throttle steam conditions

8 INSIDE AREA OF PIPE for alternative steels at progressively higher throttle steam conditions

9 HARDNESS OF VALVE SEATING and trim materials at elevated temperatures.

(1) Nickel-copper-tin alloy (50-30-12). Used for seat rings up to 850 F and for stem bushings to 950 F or higher with excellent results. This alloy is age hardening and after long exposure to temperature above 925 F approaches an ultimate hardness of 335 Brinell. Has a high resistance to corrosion in steam or air at 1100 F.

(2) Type 410 13 percent chromium steel with carbon under 0.15 percent. Above 800 F this material is used for stems, and for disks and welded-in seat rings to which a hard facing overlay is applied. Will not scale up to 1200 F.

(3) Type 420 13 percent chromium steel with carbon above 0.15 percent. Used for stems up to 1100 F; also for seating without hard facing overlay up to 800 F. Will not scale up to 1200 F. Types 410 and 420 are ferritic type stainless steels which can be heat treated to give the desired hardness whereas the austenitic type cannot be hardened for seating purposes.

(4) Hard facing overlays. Typical hardness characteristics for overlays such as stellite, hastelloy and colmonoy. These overlays retain their hardness well up to 1200 F and will not scale up to considerably higher temperatures.

far as possible, with those of the AIEE-ASME Preferred Standard for Large Turbine Generators; temperatures for pressures of 1800 psig and higher are chosen for what seems a fair pairing of pressures with temperature.

Using the code S values, Fig. 6, and the new formula for pipe wall thickness, the thicknesses shown in Fig. 7 were computed for the materials selected for discussion with reference to the steps of throttle steam conditions listed in Table 4. The example of 14 in. OD pipe shown in Fig. 7 serves to illustrate how rapidly the wall thickness of ferritic-steel pipe tends to increase at temperatures above 1000 F with reference to the more moderate increase for the Type 347 18-8 stainless steel stabilized with columbium. While several other types of stainless steel possess essentially the same strength at elevated temperature as shown for Type 347, the latter has been chosen for illustration on the grounds that columbium stabilization seems the general favorite for minimizing the tendency for deterioration in the parent metal as well as in and adjacent to welds.

The next step in getting at the economics of the situation is shown graphically in Fig. 8, where the inside areas of pipe made of different materials are compared. For example, Fig. 8 shows that for throttle steam conditions of 2400 psig,

1100 F, 10.00 in. OD 18-8 pipe has substantially the same inside area (and carrying capacity) as 14.00 in. OD P22 pipe, or 12.00 in. OD 1 percent chromium, 1 percent molybdenum, ¼ percent vanadium pipe as computed for an assumed S value. (See Fig. 6.)

Relative Costs of Austenitic and Ferritic Pipe: For the assumed throttle steam conditions, the required wall thicknesses for all three pipe materials are with one exception beyond the capacity of existing seamless mills, indicating that they would have to be forged, turned and bored. Estimated costs per foot of length for the three materials in their equivalent sizes are given in Table 5. Prices for forged, turned and bored pipe are on the basis of 25 to 30 ft lengths, whereas the single available size of seamless pipe comes in 10 to 14 ft lengths requiring an intermediate weld for each pair of lengths to put them on a par with FT and B pipe. Prices shown are at the pipe mill, to which should be added the fabricator's handling charges.

Pound-per-pound, austenitic steel costs in the order of four to five times what low-alloy ferritic pipe does. Considered in terms of cost per foot of forged, turned and bored pipe of equivalent carrying capacity as shown in Table 5, however, this ratio is reduced to about one and one-half to two times, due to the thinner wall permissible with 18-8 pipe.

For the 10½ in. OD size, however, a further economy is obtainable through using the seamless process of pipe manufacture instead of buying the more expensive forged, turned and bored product. There is at least one tubular mill in this country capable of rolling pipe up to 10½ in. OD with walls up to 2½ in. thick. Lengths, however, are only 10 to 14 ft as against 25 to 30 ft for forged, turned and bored. Hence the cost of one additional weld per 25 ft run of line has been charged against the 10½ in. OD seamless product. This adds something of the order of $40 per ft, which has been included in the unit prices for this product shown in Table 5. Put on an equal length basis, seamless 10½ in. OD 18-8 pipe costs about 40 percent more than 2¼ percent Cr, 1 percent Mo pipe of equal carrying capacity.

The spot check of Table 5 indicates that there is not much difference costwise between equivalent sizes of 2¼ percent Cr, 1 percent Mo pipe and 1 percent Cr, 1 percent Mo, ¼ percent V pipe. The latter has a slight advantage which would tend to increase when flexibility requirements are taken into account.

For a large-size unit, two 10½ in. OD 18-8 seamless pipes can be used to advantage in parallel. In this case, a single 20 in. OD 2¼ percent Cr, 1 percent Mo pipe has an internal area equal to the two 10½ in. OD 18-8 pipes, the latter costing nearly 50 percent more per foot. If a single 14 in. OD forged, turned and bored 18-8 pipe is used, it costs over 60 percent more than its 20 in. OD 2¼ percent Cr, 1 percent Mo counterpart. While frictional resistance for a single large pipe is somewhat less than for two small pipes having equal internal area, on the other hand it is stiffer in a flexural sense and presents more of an expansion problem.

The differential costs between austenitic and ferritic steels for the entire 1100 F pipe requirements of a job would be decreased when flexibility requirements are taken into account because of the lesser moment of inertia for the austenitic pipe. Likewise, there will be some saving in cost of hangers and supporting steel.

The estimated costs of Table 5 show that pipe for 1100 F steam service will be expensive at best, and they point the need for finding ways either to reduce the cost per foot or to use less feet. New methods of manufacture — such as extrusion or centrifugal casting — may prove less expensive than forging and boring. In order to use less feet of pipe, the steam lead from superheater to turbine might be made as short and direct as possible by having the superheater free to float with the pipe expansion. This is not a new idea and obviously increases the cost of the superheater; however, it seems worth reconsideration in the light of the very high pipe prices indicated for 1100 F.

Corrosion in High Temperature Steam: The resistance of steel to

TABLE 4 — RELATION OF throttle steam conditions and design conditions for steam piping as used in Figs. 7 and 8

Nominal Throttle Steam Conditions						
Pressure, psig	850	1250	1450	1800	2400	2800
Temperature, F	900	950	1000	1050	1100	1150
Design Conditions for Main Steam Piping						
Pressure, psig	935	1375	1595	1980	2640	3080
Temperature, F	910	960	1010[2]	1060	1110	1160

TABLE 5 — DIMENSIONS AND COST per foot of pipes of alternative steels having equal carrying capacity for throttle steam conditions of 2400 psig, 1100 F

Kind of steel	Size designation for equal carrying capacity A		B	C
ASTM A335 Grade P22 (2¼% Cr, 1% Mo)				
Process of manufacture	FT&B		FT&B	FT&B
Outside diameter, in.	14.00		18.00	20.00
Nominal wall thickness, in.	3.250		4.1875	4.625
Inside diameter, in.	7.500		9.625	10.750
Inside area, sq ft	0.307		0.505	0.631
Cost per ft, dollars	187.50		297.00	360.00
Cost ratio	Base		Base	Base
1% Chromium, 1% Molybdenum, ¼% Vanadium				
Process of manufacture	FT&B			
Outside diameter, in.	12.000			
Nominal wall thickness, in.	2.1875			
Inside diameter, in.	7.625			
Inside area, sq ft	0.317			
Cost per ft, dollars	170.00			
Cost ratio	0.91			
ASTM A158 Grade P8d Type 347 (18-8 Cb)				
Process of manufacture	FT&B	Seamless	FT&B	FT&B
Outside diameter, in.	10.00	10.50	12.75	14.00
Nominal wall thickness, in.	1.3125	1.500	1.5625	1.750
Inside diameter, in.	7.375	7.500	9.625	10.500
Inside area, sq ft	0.297	0.307	0.505	0.602
Cost per ft, dollars	365.00	265.00	445.00	585.00
Cost ratio	1.95	1.41	1.50	1.63

Explanatory Note — The nominal thicknesses of forged, turned and bored (FT&B) pipe have been taken 1/32 to 1/16 in. more than the computed minimum thickness, whereas the nominal thickness of seamless pipe has to be taken 12½ percent more because of manufacturing tolerances.

corrosion in steam tests at 1100 F is greatly influenced by the amount of chromium present (16, 17). Alloys containing of the order of 1 percent to 5 percent chromium are shown on test to be considerably more corrosion resistant than carbon steel or alloys with little or no chromium. Ferritic alloys containing 7 percent to 15 percent chromium are definitely more resistant than those with lesser amounts. Austenitic steels, including the 18-8 Cb Type 347, were almost immune to steam corrosion at 1100 F. These were unwelded specimens, but the same would hold true presumably with proper methods of welding stabilized austenitic steels. The test results over periods up to 14,000 hr covered by references (16) and (17) are supported by service experience with some of these materials extending for several years on a pilot installation operating with steam at 1000 F to 1100 F (1).

Of the ferritic steels, however, those containing 1 percent to 3 percent chromium with 1 percent or so molybdenum seem more promising for 1100 F steam service from a strength standpoint; this includes Grade P22 and the 1 percent chromium, 1 percent molybdenum, ¼ percent vanadium steel. Although the ferritic steels containing 7 percent to 15 percent chromium are indicated to be somewhat more corrosion resistant, they have not been accorded as high allowable stresses (*S* values) as Grade P22 by the code committees.

The research project at Purdue University (17) tends to show that the corrosion of cast steel specimens is not materially different in amount from the corrosion of rolled steel specimens. A further observation of interest in connection with valves is that at least three hard seating overlays, including stellite, hastelloy and colmonoy, are extremely resistant to steam corrosion at temperatures of 1100 F to 1200 F.

The scaling of various piping alloys in air at elevated temperatures has been investigated (18). Test results indicate that this is not a serious problem at 1100 F with the alloys under consideration. Here again, the higher chromium contents increase resistance to scaling. The fact that hot surfaces are insulated undoubtedly tends to minimize scaling, and a protective coating tends to build up through the initial exposure period.

Unfortunately, research on the subject of steam corrosion at 1100 F has not been so comprehensive as in the field of long-time strength and metallurgical stability. Further pilot experience in the resistance of low alloy pipe steels to corrosion in steam at 1100 F would be reassuring before their wholesale adoption for this temperature. There is at least an indication of a tendency for steam corrosion of low alloy steels to increase perceptibly in the vicinity of 1100 F, although the initial effect diminishes with time as a protective scale builds up. On the other hand, some spare metal is provided for corrosion in the 0.065 in. *C* allowance of the pipe wall thickness formula, and the pipe wall thickness required for ferritic steel at 1100 F is so great anyway as to provide a considerable margin for depletion by corrosion before strength would be seriously impaired.

Welded Joints

In view of the difficulty in keeping any other kind of joint permanently tight at 1100 F, the ability to make satisfactory welded joints is of prime importance. Hence it is of interest to discuss some of the problems encountered in welding the alternative types of steel available for 1100 F service.

Welding Chromium-Molybdenum Steels: Welding ferritic chromium-molybdenum pipe or casting steels such as P11, P12, P22 or WC5 or WC9 for 1000 F to 1100 F steam service is relatively simple and offers no new problems beyond those incidental to the greater wall thickness. There is adequate background for welding procedures and techniques, with assurance of obtaining reasonably uniform and sound welds. Usual practice is to preheat at 500 F to 600 F, use a welding rod that deposits metal similar to the parent metal of the pipe, and follow with stress relieving at 1300 F to 1400 F, all done without allowing the joint to cool below preheat temperature until stress relief is completed.

Welding Vanadium-Bearing Steels: Welding vanadium-bearing ferritic steels, particularly the sort whose superior physical properties depend on special heat treatment, has posed new problems. The basic idea of using an electrode that deposits weld metal having the same composition as the pipe material has not worked out too well here; it has been found that the presence of vanadium in the electrode (or coating) increases the difficulty of making sound welds. Consequently, one user of 1 percent chromium, 1 percent molybdenum, ¼ percent vanadium pipe favors welding with a ½ percent chromium, 1 percent molybdenum electrode containing no vanadium and which deposits metal of a strength considerably below par for the pipe metal (9). To compensate for this deficiency, the welding ends of the pipe are built up in advance with an overlay of deposited metal so that the weld is correspondingly thicker than the pipe wall. Aside from the question of strength, this choice of electrode has also been questioned on the score of possible graphitization at 1050 F to 1100 F with only ½ percent chromium present in the deposited metal. With respect to preheat and stress relieving temperature, the practice is similar to that for chromium-molybdenum pipe steels as noted above. Castings of this material are welded according to the same procedure.

Welding Austenitic Steels: With austenitic steels, of which Type 347 (18-8 plus columbium) is perhaps the most promising for pipe, the peculiarities of the material itself plus troubles in making sound welds render it far more difficult to handle than ferritic steels. These troubles are of sufficient importance to warrant a brief review here in simple terms. Fundamentally, an austenitic steel is in a fully austenitic condition only when it is quenched (rapidly cooled) from above its critical range; austenitic steels as actually made, however, usually contain more or less ferrite, sometimes in amounts up to 30 percent. The fact that the quenched condition is basic for austenitic steels is drastically different from the fully annealed or normalized and drawn conditions in which ferritic steels are used. Consequently, many differences exist in their behavior.

When austenitic steels are subjected to prolonged heating between 800 F and 1600 F, chromium carbide tends to precipitate preferentially at the austenite grain boundaries, thus producing an intergranular weakness. This tendency can be combated through stabilizing the material with

a small amount of columbium, titanium or tantalum added as an alloying element and expressed as a ratio of the carbon content. For Type 347 steel, the amount of columbium added is between ½ and 1 percent. The electrodes used in welding usually have a composition similar to that of the pipe metal, including the respective stabilizing element.

Owing to the basically quenched condition of austenitic steel, the preheating or stress relieving of welded joints is open to question. Preheating at temperatures above 300 F may do more harm than good. Postheating in the usual range of 1300 to 1400 F serves to hasten precipitation of carbides as well as to impair ductility and impact strength through formation of the sigma phase in the ferrite present (19). Another consideration involved is the effect of heat treatment on the tendency to form cracks in the deposited metal. In recognition of controversial opinion regarding the effect of preheating and postheating welds in austenitic steels, the code committees have omitted mandatory requirements for such. Service experience is considered too limited to permit comparing the relative safety of as-deposited with heat treated weldments.

The hot ductility of austenitic steel, particularly in the coarse grained condition, is not too satisfactory and, since as-deposited weld metal is relatively coarse, cracks frequently occur during the process of solidification. Such cracks are commonly termed "micro-cracks" although they often exceed micro dimensions (20). Different preheating and postheating treatments have been tried as a means of preventing such cracks, but without universally satisfactory results. An alternative method for preventing cracks is to use an electrode that deposits a considerable amount of ferrite along with austenite. Over-compensation with ferrite, however, may lead to weld metal embrittlement with time at service temperature through conversion of the ferrite constituent to sigma phase (21). Latitude in the chemical composition of electrodes for welding austenitic steel is closely limited, therefore, in order to avoid cracks on the one hand or embrittlement on the other. Control is obtained primarily through the type of coating applied to the core wire.

Until more experience is had with welding heavy walled austenitic materials for high temperature service, it seems advisable to examine all weld deposits with a fluorescent fluid penetrant for detecting surface cracks in addition to radiographic examination, supersonic testing or other inspection methods for locating deeper flaws (see "Fabrication and Inspection"). All cracks or incomplete penetration should be cut out and rewelded. Standards for judging the acceptability of welds examined by radiographic methods are given in the ASME Rules for Construction of Power Boilers.

Welded Joints Between Dissimilar Metals: Welded joints between austenitic and ferritic steels remain a problem for several reasons, among which are (a) the necessity for compromise between radically different welding procedures; (b) the composition of the deposited metal differs, of necessity, from one or both of the metals joined; (c) there is 30 percent to 50 percent difference in the coefficients of expansion between ferritic and austenitic steels, thus requiring a readjustment of thermal strains with every change in temperature. For these reasons, the welding of radically dissimilar metals should be avoided unless there is some compelling reason for doing so. In the authors' opinion, all possible alternatives should be explored and weighed, and a considered opinion reached, before deciding to attempt such juncture under field conditions.

If they must be joined by welding, the best procedure is to make the weld (or welds) between dissimilar metals in the shop where conditions can be controlled to better advantage than in the field, and where better heat treatment facilities are available. An example of this sort is welding a valve body into a piping system having a significantly different composition. Under these circumstances, it is good practice to weld stub ends of pipe material to the valve ends in the shop, thus simplifying the job in the field. This is true even where the compositions are not too radically different; for example, where a 5 percent chromium, ½ percent molybdenum feedwater regulator is welded into a carbon steel boiler feed line.

Another way of welding dissimilar metals together is through using a transition piece made under shop conditions and by special methods so that its opposite ends, which are field welded to the pipe, have compositions that match the respective pipe compositions. Such transition pieces have occasionally been used between chromium-molybdenum steam pipe and stainless steel valve bodies. In one variety of transition piece, a stainless section is "cast" in the shop on a chromium-molybdenum steel forging so as to obtain a long tapered bond instead of the usual V or U type of butt welding groove (22). With butt welds between dissimilar metals, the stresses caused by differences in thermal expansion are radial and may easily propagate initial defects in the deposited metal or heat affected zone. In this joint, however, the junction between dissimilar metals is more axial than radial, thus putting the juncture in shear and affording greater bond area with a layer construction that is better able to support pressure and bending stresses.

Further problems arise through the insertion and attachment by welding of stainless steel flow nozzles, thermocouple wells and the like in ferritic piping. Much has been written on the subject of joining dissimilar metals, of which references (23, 24 and 25) are cited for interest in themselves or for the extensive bibliography contained therein.

Valves for 1100 F

Somewhat different considerations are involved in designing valves for 1100 F steam service inasmuch as seating and trim have to be given attention as well as body material. Several of the issues involved follow:

Body Materials: As in the case of pipe, 1100 F is approaching the upper limit for ferritic-steel valve body castings in steam service. The following varieties of cast material conforming to ASTM specification A217 are among those under consideration by different valve manufacturers: Grade WC5, 0.7 percent Cr, 1 percent Mo, 0.8 percent Ni; Grade WC6, 1¼ percent Cr, ½ percent Mo; Grade WC9, 2¼ percent Cr, 1 percent Mo; Proposed, 1 percent Cr, 1 percent Mo, ¼ percent V.

With the exception of WC5, the foregoing list bears a general resemblance to the pipe compositions discussed earlier in this paper. High temperature properties of the first three compositions of the above list

are compared in reference (13) which holds in favor of WC5. On the other hand, there is considerable to be said for WC9, where composition corresponds to P22 pipe material.

Austenitic cast steel valve bodies are available in accordance with ASTM specification A351. Grade CF8C, which is 18-8 Cb Type 347, does not have the full high temperature strength of its counterpart in pipe form — A158 Grade P8d. This is compensated for, however, by the fact that the wall thickness of valve bodies is greater than for the corresponding grades of pipe. Grade CF10MC, which is similar to Type 347 with 2 percent molybdenum added, has greater strength than Grade P8d. In lines where austenitic pipe is used, it would seem desirable to use austenitic valve bodies to facilitate welding, if for no other reason.

For austenitic forged steel valves, Type 316 steel conforming to Grade F8m of ASTM A182 is offered by one manufacturer. This composition is 17 percent chromium, 12 percent nickel plus 2½ percent molybdenum, the molybdenum giving added strength as well as stabilizing the carbides.

Seating Materials: The need for a hard material for seating surfaces is increasingly apparent since temperatures have exceeded 800 F and the practice of welding valves into the line has become prevalent. Seating surfaces are now expected to remain tight indefinitely without having to remove the valve from the line for servicing. Hardness of the seating material at the operating temperature with sustained ability to resist scoring is of prime importance. Unfortunately, the chromium-nickel austenitic steels are not hard enough for this purpose although they are used to some extent for valve stems.

For temperatures below 800 F, hardened seat rings of ferritic stainless steels containing 12 to 14 percent chromium met with some favor as did nitralloy case hardened surfaces. For higher temperatures the use of hard overlays deposited by fusion welding on the seats and disks has been found necessary. Among the overlays commonly used for valve seating are the following:

Approximate Chemical Composition

Cobalt 60 percent; chromium 30 percent; tungsten 4 percent; iron, manganese, silicon, carbon 6 percent.

Nickel 57 percent; molybdenum 17 percent; chromium 15 percent; tungsten 5 percent; iron 6 percent.

Nickel 68 percent; chromium 18 percent; boron 4 percent; iron, carbon, silicon 10 percent maximum.

Brinell hardness numbers at elevated temperatures are shown in Fig. 9 for several valve trim and seating materials, from which the advantage of hard overlays for seating at temperatures above 800 F is apparent.

Stems and Stem Bushings: In view of the need to avoid scaling of these parts, the use of stainless steel seems called for. The choice between the austenitic and ferritic types will differ between valve manufacturers. The need remains for some difference in hardness or composition between the stem material and bushing in order to avoid galling or seizing of the parts. On this account it is possible that a nickel-copper-tin alloy similar to the 50-30-12 composition of Curve 1 in Fig. 9, which has been used at temperatures up to 950 F, may remain in the picture; in large valves the stem bushing is not swept by the steam flow and could be 100 F or so below steam temperature.

Bonnet Construction: For pressures and temperatures of the order involved here, flanged bonnet construction for large valves seems out of the question. There remains the choice between welding the bonnet joint or using pressure-seal construction. Various valve manufacturers undoubtedly will offer their own solution of the problem along one line or the other. No great difficulty is anticipated, however, in obtaining satisfactory construction for 1100 F steam service.

Fabrication, Inspection

The operations performed on pipe during shop fabrication — including bending, upsetting, swaging and assembly by welding — are all local in character and result in a lack of uniformity throughout the structure. Subsequent to fabrication, each shop assembly can be put in a uniformly desirable condition throughout by furnace heat treating in a manner intended to produce the type of metal structure and grain size most suitable to the intended service. This heat treatment may need to be a compromise so as to obtain satisfactory high temperature properties and at the same time avoid producing room temperature properties that could lead to cracking or partial failure of the fabricated part during shipment or in subsequent erection. Once the assembly is in service at a temperature as high as 1100 F, however, undue brittleness at room temperature will tend to be tempered for most materials by sufficient time at the operating temperature. With age hardening materials this may not be true, and for austenitic steels different procedures are required than for ferritic steels (20, 26).

Two schools of thought exist concerning the best type of heat treatment for ferritic materials intended for service at 1100 F or higher with respect to their aging qualities at the operating temperature. Some contend that for reasonable stability of microstructure at temperatures above 1050 F, full annealing is preferable to a normalizing and tempering treatment, although at temperatures of 1000 F or lower, micro-structural stability is assured by either method of heat treatment (27).

The possibility of obtaining superior or high temperature properties through normalizing or other favorable heat treatment was pointed out in the discussion of the same paper and in reference (9). Allowable stresses have usually been set with reference to the lower strength obtained in the fully annealed condition, whereas higher S values would be warranted with favorable heat treatments if the properties so obtained can be shown to be stable at 1100 F.

Metallographic examination of specimens from the heat treated product is a worthwhile means of quality control in that it affords a visual checkup on melting practice in the steel mill and on heat treatment methods at the mill or in the fabrication shop, as the case may be. Excellent micro-photographs illustrating what can be learned from such examination are given in references (20) and (27). For 1000 F to 1100 F service, it is desirable to obtain a micro-photograph from one end or both ends of each length of pipe. Similar metallographic examination of a specimen from an occasional weld is desirable.

Most large pipe for 1100 F steam service is beyond the capability of existing seamless mills to roll. It also seems too heavy to roll from plate for a welded longitudinal seam. Alternative processes known at the

present time are forged, turned and bored; centrifugally cast; and extruded. The first named of the three has been in commercial use since steam temperatures reached 1000 F, although there still are no generally recognized specifications for its manufacture with standardized dimensions and tolerances.

Because of the severity of the service, the wall thickness required and the high cost of the product, it is particularly necessary that inspection be thorough on each individual length. In the absence of an established specification for forged, turned and bored pipe it seems desirable that each length be examined according to the full supplementary requirements given in ASTM specifications such as A335. As a further means of inspection, ultrasonic examination for hidden flaws seems worthwhile (28, 29, 30).

A recent development for welded joints is the use of an inert gas for shielding the arc welding process in conjunction with inert gas confined inside the pipe for shielding at the root of the weld in lieu of a backing ring (31, 32). Although relatively new, this process offers considerable promise. With the extremely heavy wall required to provide even a modest pipe bore at 1100 F, any means is welcome for removing an obstruction such as a backing ring from the bore.

Radiographic examination of welded joints in all large diameter piping seems particularly desirable for 1100 F steam service in view of the thick walls and the tendency for any flaws present to propagate in heating and cooling from this high temperature. Shop welds should be X-rayed where feasible because of the greater clarity of X-ray negatives; field welds can be gamma-rayed. Austenitic welds, at least, should be examined for surface cracks with fluorescent penetrating fluid. All cracks and flaws exceeding the limits established in the ASME Rules for Construction of Power Boilers for radiographic examination should be cut out and re-welded.

$64 Question

Austenitic steel (Type 347 18 percent chromium, 8 percent nickel plus columbium) was used for the 1100 F steam piping of two 145,000 kw units installed this year by the Public Service Electric and Gas Co. of New Jersey in its Kearney station. This is the first commercial installation for 1100 F steam. A report of the problems encountered and results obtained is awaited with interest. Experimental work there and elsewhere indicates that no serious difficulties should be encountered in using Type 347 material with 1100 F steam.

The $64 question remains — whether it is necessary and economic to use austenitic steels for 1100 F steam service. On the strength of information reviewed in the present paper, the authors conclude that it should be feasible to extend the use of low alloy ferritic steels from their present top steam temperature of 1050 at turbine throttle to a possible 1100 F at turbine throttle.

Before doing so on a wholesale scale, however, it is suggested that a trial installation be made in which the 1100 F steam piping consists in whole or in part of low alloy ferritic steel. One of the items worth further investigation is the permanence at 1100 F of superior physical properties imparted to certain ferritic steels through favorable heat treatment.

[The first part of this paper was published in the August HPAC. The discussion will follow.]

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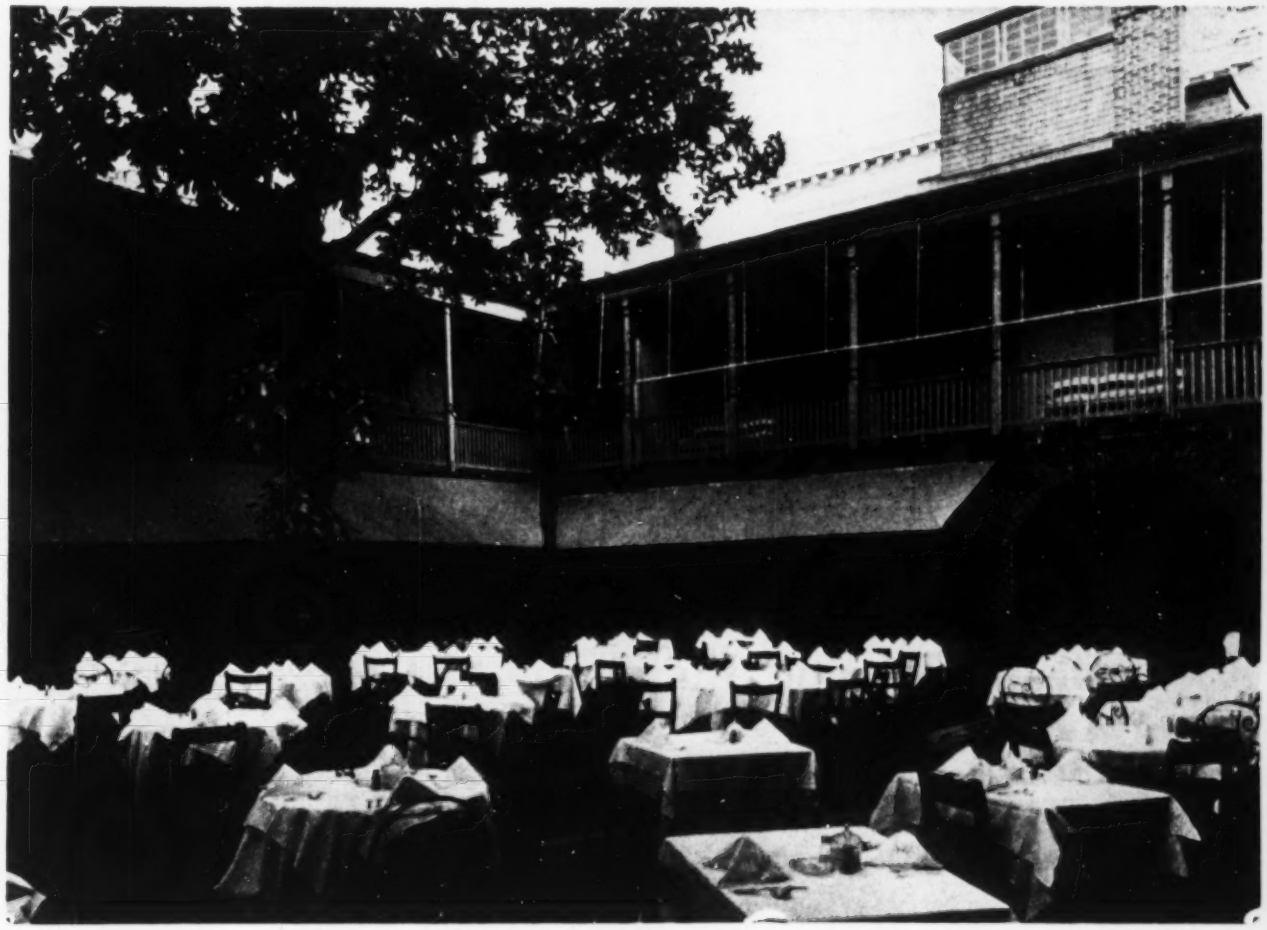


Air Conditioning the Outdoors

Historic New Orleans restaurant cools its open-air patio

WHEN THE PATIO ROYAL restaurant, at 417-25 Royal St., New Orleans — a landmark of the old French quarter — re-opened under the proprietorship of Ad Given Davis, friends and competitors alike registered some doubts as to the success of his plan for an air conditioned outdoor patio. Before the opening one columnist wrote: "Biggest novelty will be the air conditioned patio, the first anywhere in the world. This will be accomplished, Davis hopes, by pumping enough cold air under the new canvas canopy to force the hot air up over the brick walls, since cold air is allegedly heavier than hot air."

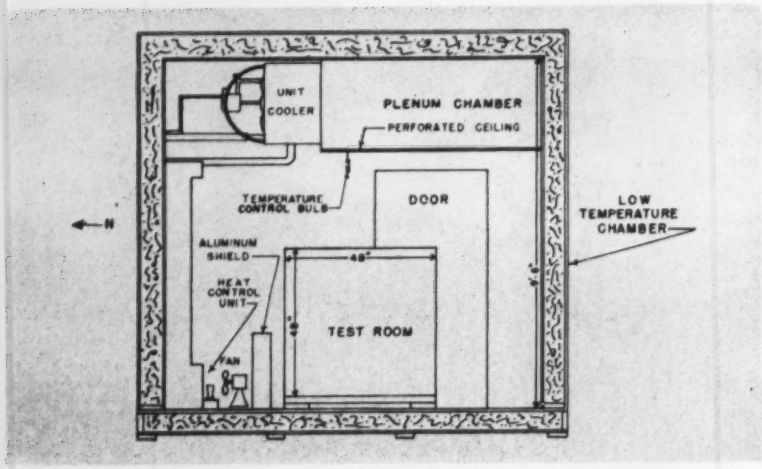
But the air conditioned patio works — and has increased business 60 percent, says Mr. Davis.

The 25 ton, 10,000 cfm air conditioning unit holds a 10 deg differential in the patio while maintaining a 76 deg temperature in the main dining room inside the building. The unit is housed under the balcony at one end of the patio, which measures approximately 40 ft across and forms five brick archways. The ducts are hidden under the balcony floor, with the grilles along the top of the archways. The patio is 78 ft long. It is enclosed on all four sides.

New Orleans has what is known as the Vieux Carre commission, and all restoration and new building projects in its area must be first approved by the commission's architect. To comply with this ruling, all duct work for the Patio Royal's air conditioning installation, as well as the building where the unit is housed, had to be camouflaged by an aging process, and all ducts had to be hidden as much as possible, to keep the courtyard in the tradition of the days of yesteryear.

The removable canvas canopy over the patio plays no part in the air conditioning, but serves to protect against rain and sun. The air conditioned outdoor patio works on the same principle as do the open top display freezers in food stores.

J. N. Becker designed the air conditioning installation. — TOM RICHARDS.



1 LOCATION OF THE TEST ROOM within the low temperature chamber is shown in this elevation view

Heating Arctic Buildings

Use of Reflective Interior Finishes

By Millard H. LaJoy and Gordon R. Whitnah

HERE'S WHAT THESE PRELIMINARY TESTS INDICATE

1) Using reflective interior treatments with emissivities of 0.05 to 0.06 and applying them to 100 percent of the area results in a saving in fuel consumption of from 20 to 30 percent over treatments of comparatively high emissivity such as 0.90, which is typical of conventional interior finish construction.

2) The use of completely reflective interior surface treatment results in a large percentage increase in radiometer measurements. This would indicate that objects of high emissivity located within such structures would receive heat energy by reflection. The amount would depend upon the temperature and emissivity value of the surrounding surface.

3) A person loses approximately one-half his heat by radiation in normal surroundings. When the interior surfaces of the structure within which he lives are treated with materials of low emissivity, it would be expected that his radiant heat loss to these areas would be reduced. This fact, together with the preliminary results obtained, should encourage further investigation of the benefits that might be available with this type of construction in conjunction with radiant heating.

[A second article will give Arctic heating design data.]

UTILIZATION OF MATERIALS for Arctic constructions requires that every effort be expended to obtain the maximum effectiveness in their application. Both the materials and fuels used for heating impose severe transportation difficulties and expense. The regions of Arctic climate present to the designer a challenge to produce a high degree of comfort with a reasonable fuel consumption. One means of accomplishing this seeming paradox appears to be through the utilization of reflective interior surfaces. As a part of a cooperative research study on radiant heating for Arctic buildings carried out by the Department of Mechanical Engineering of the University of Minnesota for the United States Naval Civil Engineering Research and Evaluation Laboratory, some experimental studies along these lines were undertaken.

This preliminary work was concerned primarily with the value of using a reflective interior surface construction. Such construction can be economically obtained by applying a commercially available aluminum foil paper which can be procured in compact rolls. A large surface area may be covered with a small amount of bulk and weight of material.

It was recognized that considerable work has been done on the insulation value of metal foils. However, there is little experimental information available as to the total benefit that may be obtained when these materials are applied as an interior surface finish. Applied in this manner, their reflective powers may provide added benefits to the occupants which are not revealed in an insulation test alone.

For example, the human subject gives off a considerable proportion of heat by radiation to the cold surfaces of structures. The amount of heat lost from the human body to these surfaces is dependent upon the difference of the fourth power of the temperatures, upon the angle factor and upon the emissivity of the surfaces. Where the lower temperature receiving surface, such as the walls, is one which has a comparatively low emissivity, then it does not have great ability to receive radiant energy. On this basis, it would be expected that a human subject, surrounded by surfaces of low emissivity, would have a reduction of his radiant heat loss; though he would lose radiant energy to the room's furnishings, which normally have high emissivity values and are at a lower temperature than the human body.

It has been established that the human body loses approximately one-

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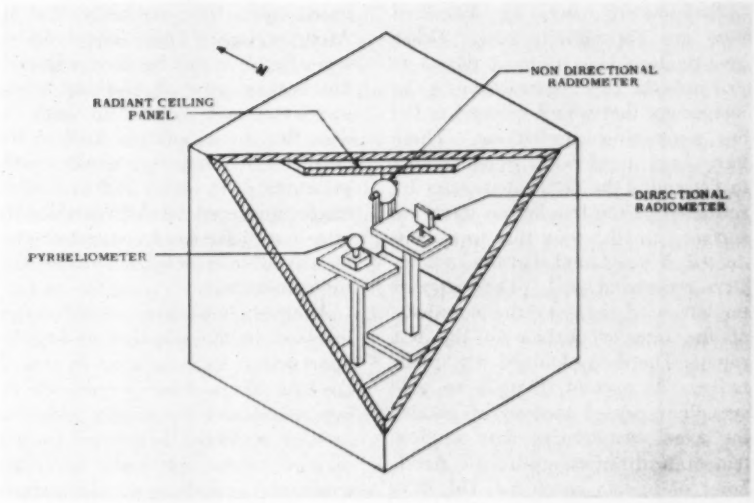
half of its heat by radiation in normal surroundings. In general, the design temperature for comfort of the human subject has been based on a comparatively high emissivity value for the surrounding surfaces.

It is conceivable that if an interior surface construction is designed to reduce this loss by radiation, then the design temperature for comfort may be somewhat lower. The use of a lower indoor design temperature would result in less heat loss from the structure, since this is directly proportional to the temperature difference between the indoor and outdoor air. This would result in a fuel saving which would be additional to that resulting from the application of conventional insulation alone.



2 THE TEST ROOM WAS EQUIPPED with an electrically heated radiant ceiling panel and radiation measuring instruments

Equipment Used in Making the Tests

The equipment involved in these studies consisted of a low temperature chamber, a small scale test room, an electric heated radiant ceiling panel, and various measuring instruments. The 2.67 sq ft electric heated radiant panel employed was centrally suspended from the ceiling. This panel had the heating element embedded in the glass and was mounted so that the glass was 3 in. from the ceiling. Fig. 1 is an elevation of the low temperature chamber and the small scale test room. A continuous supply of cool air was provided at the plenum of the low temperature chamber. Temperature control was obtained by manual adjustment of heat to a small electric heating element inside the test room. Air was circulated continuously past the element and heat was modulated to the unit by a manually operated control. With this arrangement it was possible to control the temperature in the low temperature chamber to an accuracy of 1 F. The temperature was held as closely as possible to −20 F for all tests.

The test room for these studies was a 4 ft cube (outside dimensions) and was constructed to provide an overall coefficient of heat transmission of 0.208 Btu per hr per sq ft per F. This value was considered one which might be representative of military construction in the Arctic region. All walls, the ceiling and floor of the test room were constructed identically. Two by two pine studs and plates were faced on the outside with 25/32 in. insulation sheathing; the inside was finished with 3/8 in. plywood. A plywood interior finish was selected because of the future ease of applying reflective treatment to the interior surfaces as well as to provide a smooth surface for painting. Lap joints were provided on all edges and the test room was assembled by wing nuts and screws.

In the four tests conducted, the surface finish on the interior was changed each time. Plywood was tested first in the "as is" state, then it was covered completely with a plain aluminum foil. The third test involved the use of an embossed aluminum foil covering in place of the plain foil. Finally, the foil was removed and the surface given two coats of flat black paint. The black surface and the plain plywood surface both had comparatively high emissivities, while the plain and embossed aluminum foil finishes possessed low emissivity coefficients.

Temperatures were measured with No. 24 ga copper constantan thermocouples and a direct reading potentiometer. All surface mounted thermocouples were placed at the center point of the walls, ceiling and the floor of the test room and at the center of the glass panel. Input wattage to the electric ceiling panel was calculated from measurements of volts and amperes. Two instruments were used to obtain a measurement of the radiant energy received from the ceiling panel and from other "sending" surfaces. In all tests, the temperature of the air inside the test room was maintained at 50 F. The wall temperatures were lower than this value. Therefore, instruments to be used for measurement of radiation energy would have to respond to the long wave lengths associated with the lower temperatures.

Fig. 2 is a cross section of the test room showing the location of the electric radiant panel, the pyrheliometer, directional radiometer and the non-directional radiometer. The two radiometer instruments were of special design and were constructed similarly from an electric standpoint. The only difference was that one was a non-directional unit and the second was a directional unit.

The non-directional unit was spherical in shape and the directional unit was essentially a flat plate. Arranged on the surfaces of the sphere and the flat plate were a large number of silver foil squares. These were alternately polished and blackened to give highly reflective and highly absorbent surfaces respectively. A thermocouple junction was made in each of the squares. Each polished square served as one junction and each blackened square served as the other junction of a thermocouple circuit. The sensitivity of such an instrument is related to the number of thermocouples in the thermopile. Readings obtained with both of these instruments were in millivolts. For this measurement, a conventional millivolt potentiometer was used.

Radiometers such as described here are not entirely new. Other investigators have utilized the same principle in the construction of an instrument that would respond to the low temperature radiations. These have been used with some success to determine the net heat transfer by radiation or the irradiation upon the surface. In the tests that were conducted, it was found that the radiometers responded well. They showed the effects of changing the emissivity of the interior surface of the test room. The data obtained was qualitative. At present there is no universally accepted method of obtaining exact quantitative data on low temperature radiations from a standpoint of human comfort. This was recognized as a short-coming to studies of this nature. However, qualitative data is valuable. It helps guide the way to improvements in construction methods and does show the relative effect of different types of interior surface finishes.

What the Tests Showed

All of the test results reported here represent steady state operation. The cold room and test room were in operation for approximately 20 hr prior to the start of the actual test run. These tests were continued long enough so that a period of three consecutive hourly readings gave substantially constant values. During the equilibrium period, the cold room was at approximately −20 F and the test room was at 50 F. Selection of the 50 F test room temperature was based upon the possibility that in Arctic regions a lower indoor design temperature could be used. Due to the heavier type of clothing worn, one would not require the high indoor design temperature used in the localities of less severe outdoor temperatures. An exact indoor design temperature can be determined only after tests have been conducted with human subjects under simulated Arctic conditions.

Another important consideration involved in the selection of low indoor design temperature was that if the structure possesses a radiant heating source and has highly reflective interior surfaces, the human subject may be comfortable under lower air temperature conditions. The authors feel that there is considerable merit for this approach and strongly recommend that research should be continued along this line. A comfort study should be conducted with human subjects involved in order to gain information on human comfort where radiation effects are included.

Table 1 is a summary of the test results; all values reported are an average of three hourly readings after equilibrium was attained.

The tests are numbered in accordance with the sequence in which they were actually conducted. It will be noted that the first test consisted of the interior surfaces finished with a plain plywood. This surface has a reported emissivity of 0.90. In the second test an aluminum "reflective metal board" was stapled to all the wall, ceiling and floor surfaces. The emissivity of this foil was rated as 0.05. In the third test the "metal board" was removed and an embossed aluminum reflective paper of a reported emissivity of 0.06 was placed on all the surfaces. The embossed aluminum foil was more pleasing to the eye. It was less glaring than the reflective metal board, without any appreciable difference in emissivity. In the fourth test, the embossed foil was removed and two coats of a flat black paint were applied to all surfaces. The emissivity of this treatment was reported as 0.94.

From the above it is apparent that two tests were conducted on interior surfaces with comparatively high emissivity and two tests were conducted on surfaces which were comparatively low in emissivity. Tests No. 1 and No. 4 were the high emissivity surfaces and this would be typical of ordinary construction, while Tests No. 2 and No. 3 would be a type of construction not found in conventional structures today.

It will be noted from Table 1 that the variation in controlled air temperatures for both inside room air and cold chamber air was not great among the four tests. Consequently, the variation in heat loss through the test room can be attributed primarily to the inside surface treatment.

It will be noted also in Table 1 that the warm side of the ceiling was at a higher temperature than the room air; this is expected because the electric glass radiant panel was suspended from the ceiling with the heating element in the glass approximately 3 in. from the surface. Tests

TABLE 1—SUMMARY of test results. Values are averages of three hourly readings after equilibrium was attained

Test No.	Description of interior surface treatment	Emissivity* of surface	Temperatures, F								Surfaces of glass ceiling panel	Power input to glass panel, watts	Radiometer measurements	
			Warm room air	Cold chamber air	Ceiling surfaces		Floor surfaces		Wall surfaces				Non-directional MV	Directional MV
					Warm side	Cold side	Warm side	Cold side	Warm side	Cold side				
1	None-Plain plywood	0.90	50.3	−19.5	92.3	−1.4	28.0	−11.4	41.1	−10.0	222.0	293.7	1.25	−0.22
2	Aluminum reflective metal board on all surfaces	0.05	49.8	−21.2	79.2	−9.0	21.8	−14.5	28.9	−14.2	204.1	226.7	2.81	0.52
3	Aluminum embossed reflective insulation paper on all surfaces	0.06	50.1	−21.0	81.6	−4.6	26.9	−13.6	30.2	−14.9	211.3	238.6	2.68	0.21
4	Flat black paint on all surfaces	0.94	50.2	−20.2	101.4	−1.9	33.6	−10.3	44.7	−10.8	252.5	337.6	1.62	−0.12

*Emissivity values for plain plywood taken from page 459, Heat Transmission, by W. H. McAdams, McGraw-Hill, New York; for plain and embossed aluminum paper taken from manufacturers specifications; and for painted surface taken from page 306, Radiant Heating, by R. W. Shoemaker, McGraw-Hill, New York.

2 and 3 with the reflective treatment on the ceiling showed a considerably lower ceiling temperature than the unpainted or painted surfaces. The temperature of the warm side of the floor shown in Table 1 is comparatively low. It would not be expected that comfort could be obtained with temperatures as low as these. Additional insulation could be provided in an actual structure at this point in order to raise the inside surface temperature. One of the problems in Arctic construction is the permafrost ground on which the structure is often built. Care must be exercised in the construction at the floor level in order to insure against a thawing of the ground. This can be accomplished either by applying ample insulation which will reduce the conduction of heat to the ground or by providing ventilation of the air under the floor exterior construction.

Table 1 shows the surface temperature of the walls. It will be noted that the surface temperatures on the reflective treated walls of Tests 2 and 3 are considerably lower than for the surfaces of comparatively high emissivity. This would be expected because a highly reflective surface does not have great ability to absorb heat. The human subject can be assumed to have an average clothing surface temperature of approximately 83 F as reported by Willard, Kratz and Fahnestock in the June 1933 issue of Heating, Piping & Air Conditioning in connection with their work on the eupatheoscope. Therefore, one is continually losing heat by radiation to surfaces at lower temperatures than his body. Even though the wall surfaces appear extremely low in temperature it is possible that a human subject may still obtain comfort providing these surfaces are highly reflective.

The surface temperature of the glass radiant heating panel shown in Table 1 was measured at the center of the glass panel with a thermocouple held firmly in contact with the surface. In all tests the input to this panel was adjusted so that a room air temperature of approximately 50 F was obtained. The temperature of the panel therefore would be dependent upon the input heat energy to it. It will be noted that Tests 1 and 4 representing surfaces of high emissivity required a considerable greater heat input and consequently show a higher panel temperature than the reflective construction. From the data shown, together with the inside and outside air temperature conditions, it is possible to make a comparative calculation of efficiencies. If this is done, it will be found that the reflective treated construction required from 20 to 30 percent less heat input than the non-reflective or conventional construction.

It is believed that the saving in fuel indicated above does not give the complete picture of the value of the reflective interior treatment. Additional benefits may be derived since it would be expected that the radiant heat loss by the human subject would be reduced. This is substantiated in the last two columns of the test data in Table 1. Here the radiometer measurements recorded in millivolts are given and show that with the reflective surfaces there is a rise in millivolt reading due to the reflection of radiant energy. The spherical type non-directional radiometer received radiation from all directions within the test room. It could receive radiant energy from the glass ceiling panel as well as from the walls and floor. The non-directional unit, which was essentially a flat plate, was arranged to look at the walls within the structure. Thus, it only received radiation from or emitted radiation to the wall surface. Both of these instruments indicated that a human subject would receive energy by radiation from the reflective treated surfaces. The non-directional unit indicated a positive millivolt reading in all four tests. This would be expected because it was receiving a substantial portion of radiant energy from the glass ceiling panel which was at a comparatively high temperature with respect to the other surfaces in the structure. However, the directional unit which was arranged to see only the wall surfaces, revealed that when these surfaces were reflective, as reported in Tests 2 and 3, then a positive millivolt reading was obtained. This indicated that even though the wall surface was at a comparatively low temperature, heat was being reflected off of these surfaces on to the radiometer. However, this was not the case for the conventional walls represented by Tests 1 and 4. Here the emissivity of the walls was comparatively high. A negative millivolt reading was obtained. This indicates that the radiometer itself was losing heat to the colder wall surfaces. The radiometer can be thought to respond somewhat like a human subject.

[The authors wish to acknowledge the guidance given by Professors A. B. Algren and E. N. Kemler, both of the University of Minnesota, Department of Mechanical Engineering, under whose supervision the overall research program was carried out.]

ASME Hears About New Smokescope

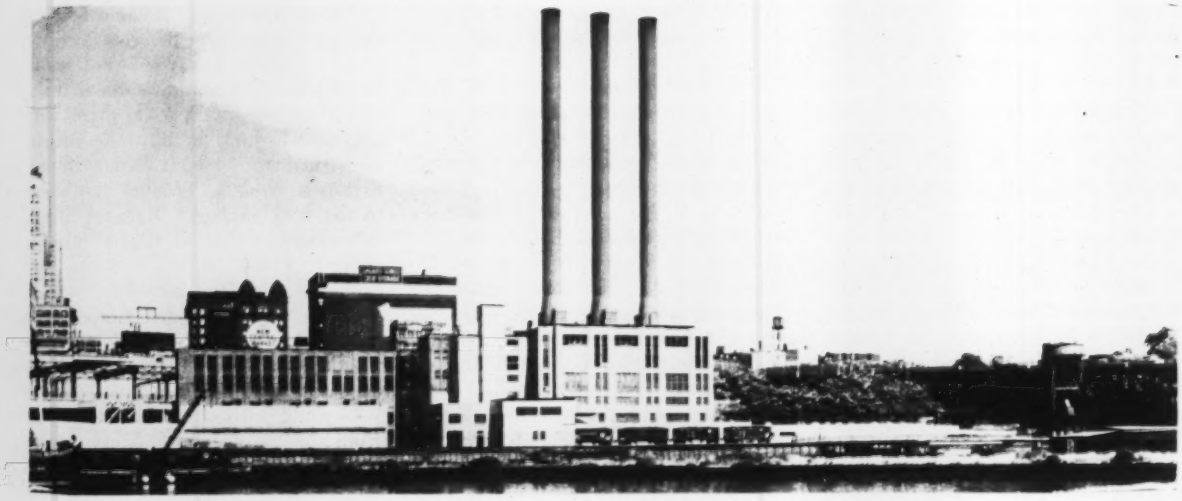
THE SMOKESCOPE, an instrument for estimating the density of smoke rising from stacks, was described at the American Society of Mechanical Engineers' spring meeting by Nelson W. Hertz, who read a paper by a co-worker, John P. Strange, principal physicist of the Mine Safety Appliances Co.

The new instrument, the speaker said, will eliminate the causes of error inherent in the methods used to date.

In the smokescope, to eliminate the effect of differences in lighting, a reference standard film disk is viewed against the background adjacent to the stack. In this manner the smoke and the reference film receive light from the same source. Smoke density estimations are therefore unaffected by background variations or by the brightness of the day.

To further improve the accuracy with which smoke density estimations can be made, a lens is used to project a virtual image of the reference standard to a focal distance equivalent to that of the stack. This makes it unnecessary to refocus the eye while making a comparison.

In the smokescope the stack is viewed through three aligned apertures in a closed, tubelike section. These apertures limit the field of vision to the area of the stack and prevent entrance of stray light. The aperture nearest the eye is the unsilvered center spot of a mirror. On the remainder of this mirror is reflected, by means of a mirror and lens, an image of the film showing the shades for various densities of smoke. Thus, the eye sees the smoke from the stack in the center surrounded by the reference film for comparison, without needing to change focus, the speaker said.



FIVE NEW BOILERS took the place of 25 old ones when Cleveland's Canal Road plant was rebuilt. The stoker fired boilers have a capacity of 750,000 lb per hr

Building Load, Cutting Costs

Reports at NDHA's annual meeting offer suggestions, review unsolved problems

By John F. Collins, Jr.

Secretary-Treasurer,
National District Heating Association

SOMETHING THAT concerns officials of many district heating utilities is that in the warmer months they sell only a small fraction — in some cases, none — of the steam they have the capacity to generate. This capacity is of course based on the amount of steam they have to deliver in the hour in winter when the demand of their customers is greatest; it is figured with their largest boiler in reserve for use in case of a breakdown among the others. Similarly, the distribution systems in most months are delivering only a small percentage of the steam they could supply. The best load factor of a reporting steam utility is about 41 percent — the average is about 29 percent.

Were it possible to sell steam all months of the year in the quantities at which it is sold in winter months — with little additional labor and practically no additional capital investment — the steam utilities would earn a higher return. Conceivably, steam might sell in the future for less and district heating could compete in areas where it cannot now do so.

A.C. Is Ideal Load

The problem is to find a use for the available steam in summer. The companies of course sell steam for water heating, cooking, dishwashing and many process and industrial uses. But while these loads are helpful in that they take steam in summer, they also take it in winter and add to the peak load. The ideal load is one requiring steam only in the warmer months. Such a one is summer air conditioning.

At the National District Heating Association's annual meeting — held this year at Lookout Mountain, in Tennessee — the air conditioning committee, of which Robert D. Martin, vice president of the New York Steam Corp., is chairman, sponsored a panel discussion on air conditioning load building. In addition to Mr. Martin, David W. Loucks, director of industrial-electric and steam sales of the Duquesne Light Co., Pittsburgh, and its subsidiary, the Allegheny County Steam Heating Co.; Wirt S. Scott, application engineer, Philadelphia Electric Co.; and Sterling S. Sanford, heating, ventilating and air conditioning engineer, The Detroit Edison Co., participated.

Mr. Loucks said that without the benefit of a special rate for air conditioning, his company had on its lines one 350 ton installation and one going in of 160 tons capacity. Factors which had led to these sales were non-availability of electric capacity at

once and the comparative lightness of the steam using refrigeration equipment — which permitted its installation on the building roof, saving basement space (which was at a premium.)

Mr. Scott described similar and more extensive progress in Philadelphia.

Mr. Sanford reported that Detroit Edison has on its steam lines one 150 ton, one 115 ton, one 14 ton and twelve 5.5 ton air conditioning installations. In addition, 500 ton and 133 ton systems are being connected — the latter will cool soft drink syrup as well as air. The demand type of rate available in Detroit enables customers to purchase steam in summer at a very attractive figure.

41,418 Tons in New York

Chairman Martin reported greater progress in New York than in any of the other cities. There the company supplies steam to 33 turbo-compressor machines, 35 absorption units and 13 installations of other types. The capacity of these 81 installations is 41,418 tons and they use 620 million lb of steam annually. The installations are in office buildings, stores, banks, theaters, restaurants, clubs, hotels, a bus terminal and the United Nations headquarters. Apartments in high rental areas are looked upon as prospects for the near future.

Installations in use take from 14 to 20 lb per hr of steam per ton, he said.

Speaking on developments in steam air conditioning equipment, John A. Gilbreath — assistant vice president in charge of the air conditioning equipment division of Servel, Inc. — said the progress has been great in the past two years with new sales records and increasing recognition by consulting engineers, architects and building owners of the advantages of steam. He said that most of the steam equipment sales had been made outside the district heating field, the utilities not all having recognized the benefits to them. He felt, however, that as air conditioning by electricity increases, adding to summer electric peak loads, the electric companies that also sell steam will want to supply energy from their steam systems before increasing their electric system investments.

Mr. Gilbreath enumerated the types of equipment being manufactured in capacities from 3 to 1000 tons. He said that, because they have no moving parts, the absorption units are quiet and vibrationless. Using water as a refrigerant the machines are not restricted in use by codes. Being very flexible, they operate well over a wide range of conditions on a low unit steam use at any pressure.

Mr. Gilbreath said the installation cost averages $600 per ton, but varies widely depending on the system's complexity.

Process Steam Sales

Next to air conditioning, process steam uses are most valuable to improve the load factors of district steam companies. The subject was treated in two of the three papers given on the program of the sales development committee, headed by Norman Davidson, of the Rochester (N. Y.) Gas and Electric Corp.

In the first of these papers, James W. Heaton, supervisor, industrial division, Philadelphia Electric Co., pointed out that process uses not only improve load factors but often may be obtained by the utility at little first cost, that they bring in a worthwhile revenue, and that they are sometimes useful in obtaining heating load. Mr. Heaton cited the use of district steam in processes for manufacturing pharmaceuticals, wood veneers and phonograph records; in rebuilding and retreading tires; and in sterilizing bottles.

In the second paper, Dewitt Pike, formerly general sales manager of the Rochester Gas and Electric Corp. — a company which has increased its annual steam sales in the last decade from $1 million to $3 million — reiterated the excellence of process load for steam utilities because it increases their load factors, which he said are the measure of the extent to which investment in their facilities is being used.

In the third and final paper on the sales program, Edward J. Flahie, heating supervisor, Toledo Edison Co., showed how much cleaner the Toledo atmosphere is since the inauguration of a smoke abatement program.

11 Ways To Save Steam

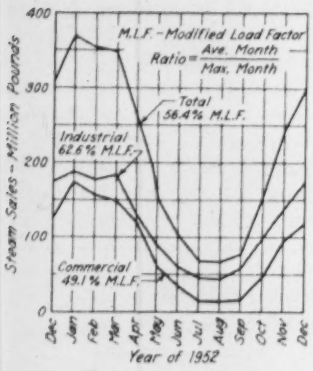
The commercial relations committee, of which Carl W. Signor — supervising engineer, customers' steam service department, The Detroit Edison Co., is chairman — had three prepared papers, including one on the subject of reducing customers' steam demands by Carl B. Sprenger, also of Detroit.

To postpone expensive additions to their systems, growing steam utilities seek means of keeping down the maximum steam demands of their customers. Mr. Sprenger said that where demand type rates are in effect, the customer finds it of advantage to cooperate in this effort. He then gave 11 ways to decrease customers' demands:

1) Install temperature controls. If a large building, zone and stagger morning warm-up periods. Extend warm-up period.
2) Use process steam during off-peak hours only.
3) Limit ventilation to minimum requirements.
4) Install thermostatic controls on roof-tank heaters.
5) Keep system in first-class condition.
6) In a vacuum system, maintain the proper vacuum and pressure.
7) Do not over-heat the whole building to correct a local condition.
8) Use condensate to preheat domestic water
9) Compare consumption records with theoretical requirements.
10) Study and understand the system.
11) Do not waste heat.

Operation and control of a special type of heating system was explained by Lewis Smith, of the C. A. Dunham Co. It might be designated as a one-pipe, down feed, high vacuum system having convectors placed under windows. All valves, orifices and traps are in the basement, and maintenance men need not enter the occupied area of the building.

The Osendorf-Morris Co., Cleveland, manages some 80 buildings occupied by multiple tenants. The company formerly assigned superintendents to see that steam was saved by the various temperature controls in from one to 10 buildings, but with the installation of a control system invented by Mr. Stem of their organization, they feel they have a much more satisfactory operation. Mr. Crandall of the company described the two-wire system by which one highly trained operator constantly at a bank of controls in one build-



PROCESS LOAD increases the steam utility's load factor. This chart of 1952 steam sales in Rochester, N.Y., shows the effect of commercial and industrial load in the summer months

ing regulates heating in a group of buildings.

Cutting Distribution Costs

As in past years, the distribution committee — presently guided by chairman Vernon J. Suche, steam utilization engineer at the Union Electric Co. of Missouri, St. Louis — has been searching for ways and means to decrease the cost of steam distribution system extensions. The committee presented six papers, several of them touching directly on this subject — which is of major importance to the steam suppliers, for if the lines cost less they can afford to make extensions to points now too distant.

In the first paper, Alexander Douglas, superintendent of underground lines, Cleveland Electric Illuminating Co., and Louis J. Hoeflinger, superintendent of the distribution department, New York Steam Corp., described work simplification to reduce cost — that is, increasing production through reducing the effort of a worker.

Mr. Douglas said that in Cleveland a small group took a training course. They in turn instructed others in the economics involved, the tools used in such studies, material handling and space layout, motion economy and work distribution. Many suggestions have been received from employees who are enthused.

During the year a survey was conducted by John L. McKinley, Denver, Harvey J. Bell, Evansville, and John T. Davis, Indianapolis, to locate new materials suitable for main construction. Mr. McKinley reported that a natural bitumen occurring extensively in Utah had been found. It is poured out of bags around steam lines to the desired thickness and tamped lightly. When steam is turned on, the material next to the pipe surface forms a dense, plastic, waterproof covering. The remainder becomes semi-plastic, with voids forming an insulation.

Homer F. Hatfield, mechanical research engineer of the Pennsylvania Power & Light Co., and John F. West, Jr., of the same company, conducted during the year an investigation of practically every item included in underground conduit and pipe installations. They collected information from 13 of the larger utilities.

Their recommendations for cutting costs are:

1) More careful field surveying to locate buried obstructions to permit maximum use of power equipment.
2) Closer supervision and more engineering.
3) Use of basic materials to lengthen life.
4) Use of prefabricated pipe and precast concrete manholes.
5) Installation of conduit under sidewalks.
6) Decreasing trench dimensions.
7) Mechanical handling of pipe.
8) Welding at street level.

Heat Loss from Piping

Some years ago, the Philadelphia Electric Co. investigated the dissipation of heat from underground steam lines in streets filled with other buried utility structures. This past year a more thorough investigation was made, using a 24 in. steam line covered with asbestos insulation 3 in. thick.

Ellwood A. Clymer, Jr., of the company reported that it takes several months after steam is in the line before the heat storage capacity of the earth is reached. The greatest dissipation of heat is upward, especially in winter. The greater the depth, the less is the effect of seasonal air temperature changes on soil temperature. On the line tested, soil temperature was increased as far away as 12 ft from the conduit wall.

A report was made by John C. Haroldson, Duluth Steam Corp., and Peter Barry, Rochester (N.Y.) Gas and Electric Corp., on the deterioration of sewer lines draining manholes. Seven utilities having 2300 manholes reported no deterioration. Six of these use bell and spigot vitrified tile pipe and cement mortar joints.

Expansion Joint Maintenance

For a second investigation by the same men covering corrosion and erosion of expansion joint sleeves, 15 utilities reported on 4500 joints from 2 in. to 30 in. in size and from four years to 36 years old. Four companies with rather new joints and two with old reported no corrosion. One of these with 82 joints in sizes from 12 to 16 in., averaging 27 years old and operating at 120 psi reported no trouble.

There was no consistency in joint maintenance practice:

1) Some companies inspect daily, some only twice a year. The average is three to four weeks.
2) Some companies lubricate every two weeks, others only once yearly. One company does not lubricate. Still others lubricate only when repacking.
3) Most companies pack only "when needed," which varies among them from six months to 20 years.
4) Some companies do and some do not drip expansion joints.
5) There appeared to be no relationship between street salting and corrosion or erosion of sleeves, indicating the protection methods are adequate.

Cathodic protection of buried steam lines has become of interest to the district heating industry, so this past year the subject has been under investigation by George K. Saurwein, mechanical engineer, Negea Service Corp., Cambridge, Mass.

First defining corrosion as the "operation of nature to break down metals refined by man to their original ores," Mr. Saurwein said that this is accompanied by chemical change and electrical current flow — always from a metal of higher potential to one of lower potential. Simultaneously, there is an eating away of the metal.

In moist soil, current flows from new to old pipes, from steel to copper and brass ones. The attack is

not evenly distributed and pitting proceeds until there is a hole in the pipe.

There are several methods of protection:

1) Protective coatings are applied.
2) Insulating joints are placed in lines to stop the current flow.
3) A counter electromotive force of higher voltage is applied to the metal surface.
4) Combinations of these methods are employed.

Mr. Saurwein mentioned also that parts of stainless steel are more corrosive-resistant, and that steam lines in tile or concrete conduit are protected by not being in contact with wet soil.

Steam Rates

Included in the report of the rates and regulations committee — arranged by its chairman, Clifford O. Thurlow, rate engineer, Commonwealth Services, Inc., Jackson, Mich. — were two papers on preparations by two steam companies for steam rate cases in which they were involved.

In the first of these, Ralph B. Grierson, rate engineer, The Detroit Edison Co., presented the procedure involved in the preparation of a cost of service study to be used as a basis of new steam rates.

In the second, Kenneth W. Hasbrouck, vice presidential assistant, New York State Electric & Gas Corp., gave step-by-step their moves in successfully presenting their case for higher steam rates to the state public utilities commission.

Metering a Problem

Three papers resulted from the year's activities of the metering committee, headed by William G. Gillim, assistant superintendent, customer service department, New York Steam Corp.

W. W. Stevenson, steam heating engineer of the Pittsburgh steam utility, criticized present methods of measuring district steam. He said several meters are often required to do what one should be capable of doing. Another source of power than the flowing steam is required with some meters. Others will not measure a sufficient overload. Changes must be made to some between seasons. The position of some meters in the system is such that all steam may not be measured if there is leakage.

Mr. Stevenson said that before meters can be improved, unanimity of opinion about metering needs must be developed.

For the past five years, the Ohio Edison Co. in Akron has been working to attain better steam measurement. Percy A. Hyde, supervisor of steam sales and distribution, and his assistant, Robert C. Wilson, described the changes made in meter types and sizes and in meter installations and piping, carried out to produce the desired results.

The third paper was a progress report by Edgar R. Loud, development engineer, Builders-Providence, Inc., on a pressure compensator for the shunt flow meter, intended to make this meter operate accurately under varying pressures.

In discussing the metering of steam, Mr. Saurwein said that an electronic type of flow meter is being developed which overcomes low-flow limitations.

Generating Steam

The final technical report of the annual meeting was by the steam station engineering committee. Walter M. Gillespie — chairman, and assistant to the manager of the heating division of the Dayton Power and Light Co. — had arranged for three papers on steam generation.

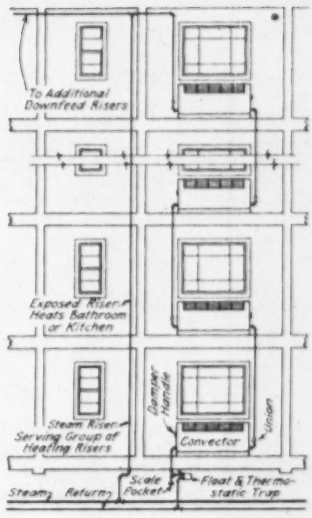
In the first of these, Charles E. Richards, supervising engineer, technical engineering division, Cleveland Electric Illuminating Co., described how the Canal road plant was rebuilt, five new boilers taking the place of 25 ancient ones, and all while supplying steam service. The five new stoker fired boilers have a capacity of 750,000 lb per hr.

David O. Foltz, associate engineer, heating plants, The Detroit Edison Co., described experiments made at one of the plants on the baffles in the boilers. Better distribution of air to the fuel beds resulted, making the plant more efficient and more easily operated at higher steaming rates.

Carl E. Miller, assistant manager, industrial division, Combustion Engineering, Inc., spoke on standardizing boilers for district heating.

He pointed out that standardizing decreases investment and operating costs, permits an earlier start on foundations and piping, and assures quicker delivery of the equipment. Factors hindering standardizing are the use of various fuels and the adoption of a number of methods of handling such fuels. Standardized boilers are available only in the smaller sizes but boilers of nearly any capacity made up of standardized parts are available, he said.

[Mr. Collins summarized the business reports on district heating given at this meeting in the August HPAC.]



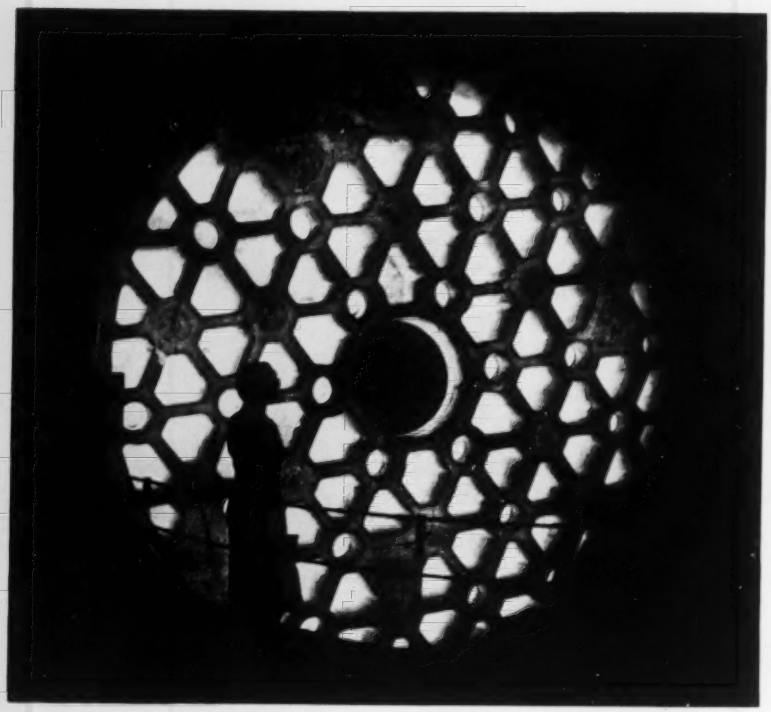
ALL VALVES, ORIFICES AND TRAPS of the heating system described by Lewis Smith are in the basement of the building

What's Cost to Tenants for Air Conditioning?

How much does it cost to provide air conditioning to a building's tenants?

In connection with this question, it is interesting to note that the Fidelity-Philadelphia Trust building has notified its tenants that it plans to install a modern air conditioning system within the near future.

Upon completion of the installation, the tenants were advised that it would be necessary to increase rental rates about 80c per sq ft per yr, based on the engineer's estimates, according to Skyscraper Management, published by the National Association of Building Owners and Managers. This cost would include the expense of operating the air conditioning system and fixed charges, with no element of profit.



LARGEST PIECE OF GLASS ever cast, which dominates the Center entrance lobby, is the 20 ton, 200 in. glass disk, twin of the one now in successful operation in the Hale telescope on Palomar mountain, California. The center hole in the disk is used as a return air intake for this room

Presents Challenging Problems

Air Conditioning Existing Building

Air conditioning found imperative for Corning Glass Center after one summer of use. How job was done

By Henry E. Peck and John Owen

Henry Peck Associates
Consulting Engineers

Plant Engineer
Corning Glass Works

INSTALLING AIR conditioning in the Corning Glass Center presented one of those challenging and interesting problems with which air conditioning engineers are frequently faced.

In 1951, Corning Glass Works completed 100 years of unbroken activity in industry. To commemorate this centennial, the company erected the Center, dedicated it to the history, art and science of glassmaking.

Air Conditioning Imperative

The inspiration to build the Center was not crystallized in its final form until the middle of 1950. To have it ready to open by the summer of the centennial year meant that the project had to be designed and built in less than nine months. While it was recognized that air conditioning would be desirable, there was not enough time to incorporate it in the short period in which the building had to be completed. It was decided, therefore, to leave it up to the ingenuity of the engineers to add air conditioning later if it was found to be necessary.

After the summer of 1951, during which the attendance exceeded all expectations, it was realized that air conditioning was imperative.

To provide the Center with air conditioning involved a variety of unique and interesting problems. Within the building are:

1) A large, multi-purpose auditorium capable of seating more than 1000 people and which "doubles in brass" for boxing matches, basketball games, various company banquets and social functions, community and civic activities, summer theater, concerts and lectures. Since it is such a versatile room, the air conditioning system serving it must be flexible.

2) A small theater and lecture room with a capacity of 90 people.

3) The Hall of Science and Industry, where many interesting exhibits demonstrate the part glass plays in today's world.

4) The Corning Museum of Glass.

5) A reference library housing one of the most complete collections of printed works on glass.

6) A retail store, where Steuben crystal may be purchased.

7) A large room containing a soda fountain and snack bar area seating 140 people, souvenir counters and a lounge area.

8) A bowling hall with nine alleys.

9) Game and recreation rooms for Corning employees.

10) A dining room and club rooms for Corning executives.

11) A group of administrative offices.

12) The factory where Steuben crystal is made.

Large Cooling Load

With the exception of the Steuben factory, the entire Center is air conditioned. The cooling loads are unusually high and variable because of the glass walls and absence of shade, and because of the large and varying numbers of visitors (over a million, since the official opening in May, 1951.)

The loads total approximately 300 tons, and require the circulation of approximately 100,000 cfm of conditioned air.

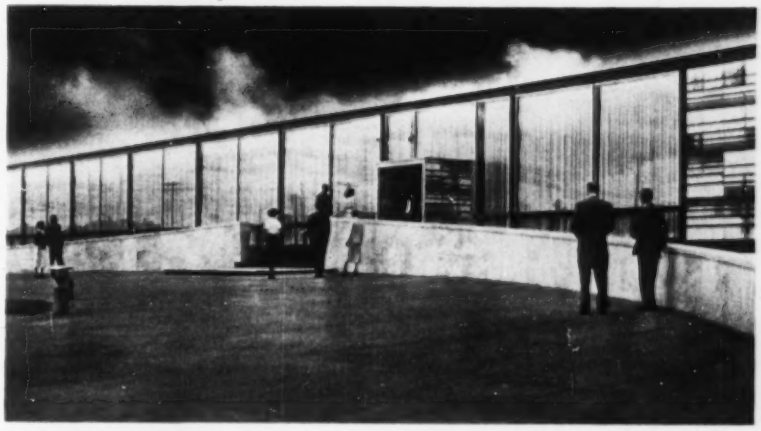
A system of chilled water circulated to conditioning equipment for each area or group of areas seemed the logical solution to handle the varying loads and to fit the available space. The high dehumidification loads occurring in populated areas — particularly at night — require a low water temperature to hold the required dew points, and 40 F water, supplied by centrifugal "Freon" compressors and water chillers, is used. To accommodate the extreme range of loads, and to facilitate installation in the limited headroom of the ground floor of the building, three units are employed, each with one-third of the total capacity. This provides flexibility for meeting the changing loads. The compressors are directly and hermetically connected to a 3600 rpm motor with no step-up gear, and there is no noise transmitted to the building from the compressors in spite of the compressor location under the library.

Two principal groups of areas are served by combined fan systems, each of which supplies three adjacent areas. In each of these systems a single supply fan sends air to separate cooling coils followed by reheating coils for each area.

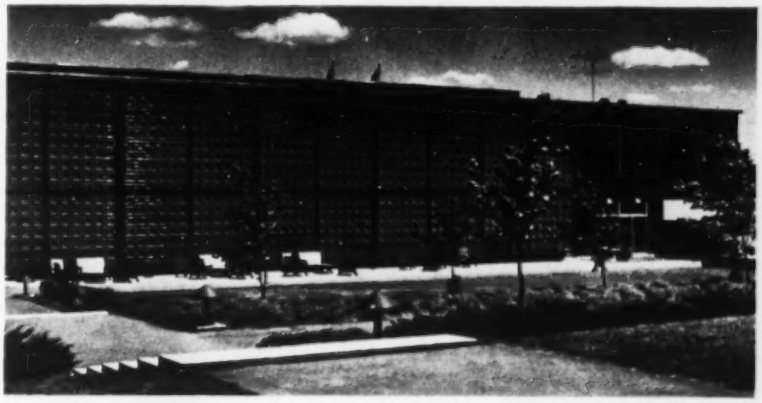
Separate Outdoor Air Fans

To provide outdoor air to these systems in the large quantities required meant that the air must enter through existing intakes that were smaller than desirable. To avoid placing this extra static pressure load — and, therefore, higher noise level — on the main circulating fans, separate outdoor air input fans were employed. With these fans it is practical to precool and dehumidify as well as preheat the outside air as it is introduced.

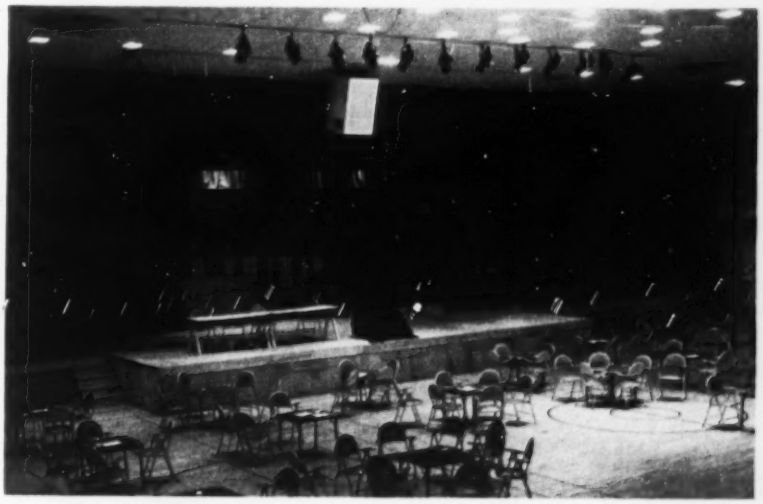
Electronic controls are used. They are set up to take advantage of the independent cooling and dehumidify-



IMPRESSIVE MAIN ENTRANCE to the Corning Glass Center features huge plate glass windows, which make up most of the building walls



GLASS BLOCKS form the back wall of the auditorium. Since no daylight was wanted in the room, the blocks were painted on the inside with bright aluminum paint, cutting down the heat from the afternoon sun



LARGE AUDITORIUM, which may house a boxing match one night, a banquet the next, and summer theater the next, has conditioned air supplied through ceiling diffusers

SUSPENDED CEILING of fiber glass panels in the Museum provides space for concealed ductwork. The air diffusers can be seen above a lighting cove. After a full winter's use, it was found that comfortable conditions in the severest winter weather could be maintained by the conditioned air from these diffusers alone, despite the 14 ft windows

EXPOSED DUCTWORK in visitors' lounge on ground floor presents a clean and unobjectionable appearance because of its unique inside seam construction

ing capacity of the systems, and to provide control of both the dry bulb and relative humidity. A thermostat — or, in the case of the larger spaces, two or more thermostats — readjusts a submaster air ductstat to control water flow to either the cooling coil or the heating coil to each zone. A space humidistat can also bring on the cooling coil, even though the thermostat is satisfied. This extra cooling causes the thermostat to call for heat, thus producing the cooling followed by reheating required for dehumidification. This seemingly elaborate interconnecting of multiple controls is done rather simply with the electronic controls, which is one of the reasons they were selected.

Water for the condensers is supplied from a 100 ft well. After being used, it is discharged back into the ground in a second well at a depth of about 40 ft — thus solving the problem of the inadequacy of the local storm sewer system for this much water.

Air Opening in Big Glass Disk

The visitor enters the Center through a spacious lobby, the focal point of which is the initial casting of the 20 ton, 200 in. mirror disk designed for the Hale telescope on Palomar mountain, California. The largest piece of glass ever cast — and twin of the one now in successful use in the telescope — the disk is lighted from behind with photomurals of the nebulae on either side. The remainder of the lobby is dimly lit in order to emphasize and dramatize this outstanding glassmaking achievement.

The big disk serves a unique purpose in the air conditioning system. The engineers were faced with the problem of locating the return air opening for the lobby without affecting the appearance of the wall. Happily, it was suggested that the 3 ft diameter center hole in the disk itself could be used for this return air opening. Supply air from the room comes from grilles above the disk, almost invisible in the dark wall.

Considerable study was given to the design of a circular grille for the return air opening, until it was realized that with the brilliantly lighted glass surrounding it, no grille at all was needed.

The return duct behind the open-

ing was treated with a flat black lining. This provides for unobstructed return of the air from the lobby to the conditioning chamber in a room behind the disk, with no apparent change to the wall itself.

Exposed Sheet Metal Ducts

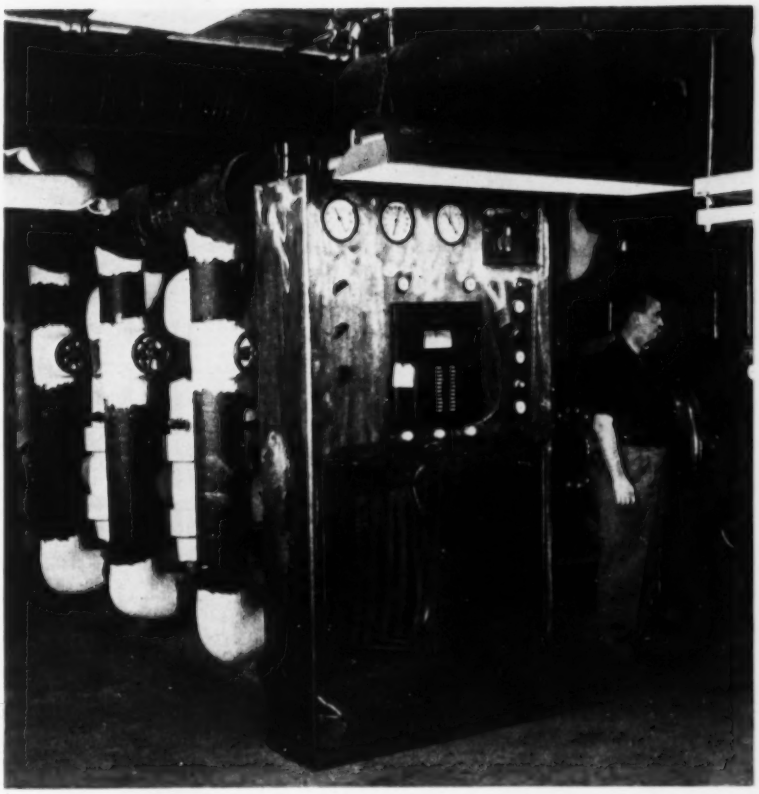
The Hall of Science and Industry surrounds an outdoor garden enclosed in a 36 ft diameter glass cylinder which is open at the top. Large crowds of people, plus the considerable sun heat coming through the glass cylinder, created the need for a large volume of distributed air for cooling this room. There was no space above the ceiling for ductwork, and any extensive lath and plaster furring to conceal ductwork would seem out of place in this room where naked steel columns are part of the architecture.

The problem was solved by locating bare sheet metal ductwork along both sides of the long way of the room, with side wall air diffusers in each bay. This duct is made of 14 gage furniture steel, with all bracing inside. The result is a smooth, flat outside surface which blends into the walls and room appearance in an almost unnoticeable manner. This duct construction not only solved the problem of air duct appearance in this room but proved less costly than the regular lock seam ducts of standard metal gage covered with lath and plaster furring.

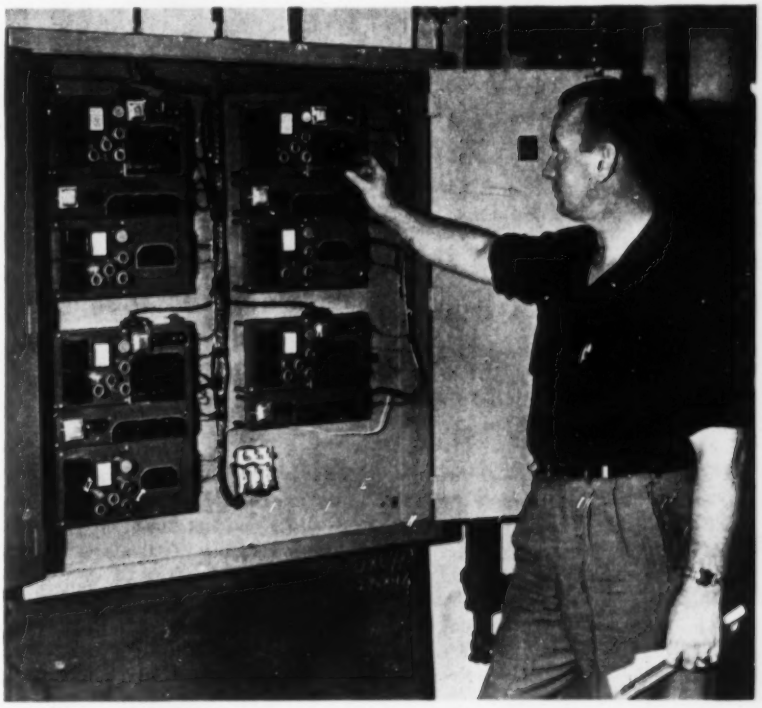
The same scheme of smooth surfaced exposed ducts covered only with flat paint is used in the snack bar and lounge room below the Hall of Science and Industry. Here, the smaller story height made anything but exposed duct work almost impossible. In spite of this, the air ducts are so unnoticeable that the average guest is unaware they are there.

Every effort is made to maintain proper temperatures throughout the Center, depending upon outside temperatures and the population of the various areas. Thus, for example, when the auditorium is being used for a sizable function, more cooling can be drawn to this area from less populated sections in the Center. The system has been operating smoothly since its installation. The air conditioning installation was made without closing the building to the public at any time.

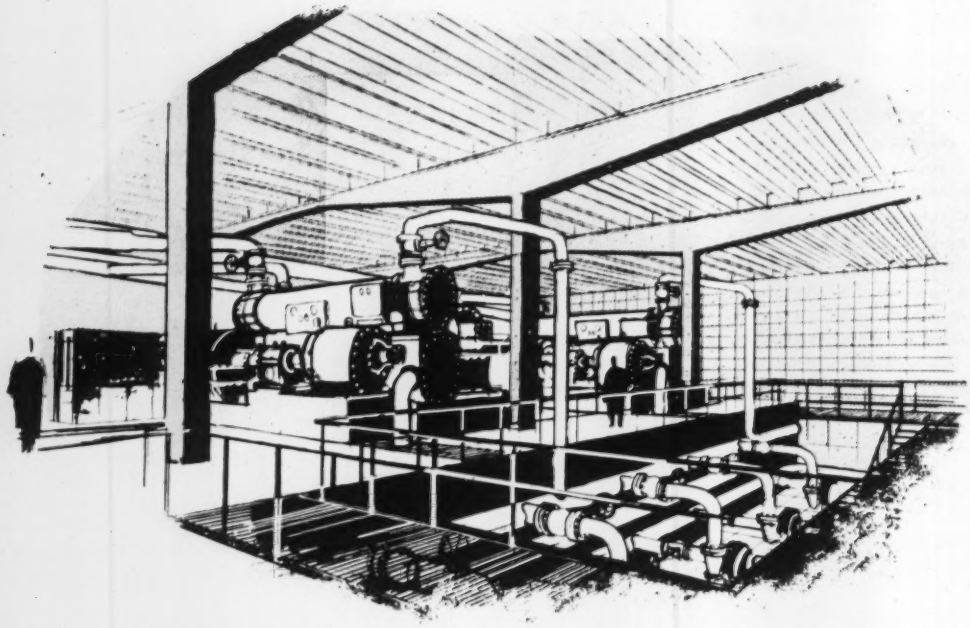
Air conditioning contractor was the American Warming and Ventilating Co., Elmira, N.Y.



MAIN COMPRESSOR ROOM, showing one of the three centrifugal compressors and the compressor sequence control panel. Operation of the plant is wholly automatic



ELECTRONIC CONTROL panel which controls temperature and humidity in four of the areas



CHILLED WATER FOR AIR CONDITIONING and steam for heating are supplied the Northland Center buildings from a central plant

Big New Shopping Center

Central plant supplies steam for heating, chilled water for air conditioning at the "king-size" Northland Center, Detroit

By Joseph B. Olivieri

Chief Mechanical Engineer
Victor Gruen Associated Architects and Engineers, Inc.
(as told to Haviland F. Reves)

A CENTRAL BOILER PLANT was the logical selection for heating the $20 million Northland shopping center in Detroit, but a judicious mixture of engineering considerations and "psychology" resulted in "compromise" for the air conditioning system. Individual tenant plants will use steam and chilled water from a central plant, rather than furnishing air conditioning service either by a central plant or by individual tenant plants alone. The significant factors that determined the ultimate choice are of equal interest to a physical description of the installations. For a proper understanding of the magnitude and intricacy of the problems and decisions involved, it is necessary to describe briefly the nature and scope of the entire project.

Northland is the first of three — or, possibly, four — major shopping centers projected by the J. L. Hudson Co., the world's second largest department store, and one of the pioneer users of store air conditioning. The major centers are to be located at strategic intervals around the perimeter of Detroit. Northland is now under construction.

Four Development Stages

The Northland center utilizes about 400 acres, and is to be developed in four stages:

Stage I — This is the one now under construction, with which we are immediately concerned, and includes the major department store to be occupied by Hudson's itself as the firm's first branch unit, and five buildings to house tenant stores of suitable types. The department store building — the heart of the project — is es-

sentially a three story structure of 471,396 sq ft with additions possible in a later stage. The five tenant buildings will provide space for 70 tenants, all in one story buildings, with an area of 500,000 sq ft.

Stage II — Two junior department stores will be added, of 100,000 sq ft area each, to be occupied by other department store firms actually in competition with Hudson's. In addition, two more tenant buildings providing space for 20 more shops will be constructed. Each of the latter two buildings will have a total of 100,000 sq ft, making a grand total of 1,380,000 sq ft for the shopping area proper.

Stage III — This will include a 10 story medical-dental building, a three story building housing general offices, and a three story research building.

Stage IV — This will cover both multiple dwellings and single homes to be built in other portions of the site development.

No time schedule has been set for the three later stages, but it was necessary to take them into consideration in planning the heating and air conditioning facilities from the start.

The selection of the type of installation was made after a thorough study of all pertinent factors under three general aspects — economic, functional, and architectural. At some points, several alternative combinations were at least theoretically possible, and the merits and disadvantages of each were carefully analyzed. As will be evident in the discussion, the significant factors rarely pointed all to the same choice, and a careful evaluation of relative importance was necessary, involving a fusion of architectural, engineering, and economic considerations with the objectives and operating policy planned by the owners.

Economic factors are naturally divided into two basic categories — investment or initial cost, and annual operating cost. Because this project pioneers, with little if any operating history to serve as a guide, it was necessary to rely upon informed estimates at many points.

Investment Costs

Careful projections of the investment cost of the various types of plants under consideration were made. These results are summarized in comparative form in the first column of Table 1. It was possible to establish cost figures within reasonable limitations through standard methods.

It should be noted that the capital cost figures appear to run counter to the ultimate logical selection of the central boiler plant, but that other factors — notably operating cost — favored this type of installation. This highest investment cost in the central plant may also appear paradoxical, since it may seem at first consideration that the installation of numerous isolated plants would mean a considerably higher investment cost than would a single large central plant with its apparent economies.

Two factors appear to account for this paradox: The requirements of special design and fabrication of the central plant, in contrast to the relatively standardized and mass-produced nature of the smaller individual plant units; and the corresponding relative complexity or simplicity of the two types of installations, with their resultant effects on labor and incidental costs.

Determining Operating Cost

Determination of operating cost, however, presented genuine difficulties, not only because of relatively scanty operating experience but because records of the various factors in the case of individual tenant plants are generally lacking — though records for central plant installations are available. This matter of operating cost requires special attention because it enters directly into the important matter of metering services provided to tenants.

Operating costs as considered here consist of six basic classifications of charges: (1) Labor and maintenance, (2) electrical energy, (3) water, (4) lubrication, (5) rent of space occupied by equipment rooms, and (6) amortization of the capital investment. The sixth factor, incidentally, is omitted from the metered charges to tenants as far as the steam plant is concerned, since this plant is traditionally provided in one form or another by the landlord, but amortization is charged on the air conditioning system — a fundamental distinction is historic usage and tenant acceptance.

Standard or handbook formulas cannot be used directly in calculating costs or in prorating charges for some of these cost elements. For instance, fuel costs are affected by the fact that the heat gain from lights and people in retail shops will at times equal the heat loss. Labor costs in the individual plant are especially difficult because the portion of time of whoever runs the plant must be suitably broken down. Water and electrical energy charges for the individual tenant are not segregated from the total consumption used for other purposes. The elimination of individual plants in the tenant buildings results in more usable merchandising space — an important consideration, since retail store space is rented on a square foot basis.

Present thinking, incidentally, is that the estimated life used as the basis for amortization of central plant equipment should be extended somewhat in the light of experience now available. It is suggested that a life of 35 to 40 years be used for boilers and at least double this for brick and steel boiler house structures. Experience of the original Hudson store as the first department store to install air conditioning indicates that the life of central plant centrifugal compressors is at least 30 years, while that of small reciprocat-

TABLE 1—SUMMARY of economic studies, the most expensive installation being rated as "1"

(*Indicates type of installation selected)

Type	Initial cost	Annual operating cost
Steam Generation		
*A. Central boiler plant	1	3
B. Individual boiler plant for each building	3	2
C. Individual boiler plant for each tenant	2	1
Refrigeration		
*A. Central chilled water plant	1*	3
B. Individual chilled water plant for each building	1	2
C. Individual direct expansion plant for each tenant	1	1
Heating and air conditioning for typical building		
A. Central building plant using steam and chilled water from central plants	3	1*
*B. Individual tenant plant using steam and chilled water from central plant	4	3
C. Individual tenant plant using steam from a central plant and refrigerant from tenant's plant	2	2
D. Individual tenant plant using steam and refrigerant from tenant's plant	1	1

*Equivalent cost figures mean costs are the same.

ing refrigeration compressors is about 15 years.

All the foregoing factors affected the weighing of economic factors for the Northland project, which have been summarized in comparative form for this article from the calculated cost figures. Each of the types of installation given serious consideration is rated according to comparative costs, with the most expensive installation rated "1".

Stores Need Flexibility

Functionally, the controlling requirement is flexibility in the retail stores. Tenants are constantly changing or doing extensive intra-store remodeling. An individual tenant may take adjacent space when a unit becomes available.

These changes can be very expensive and difficult under the best of conditions. The presence of additional equipment and installations in each store unit complicates the problem of planning any changes. However, a central plant minimizes the extensive changes in both boiler and refrigeration services as compared with individual tenant plants.

The desirability of maximum flexibility means that a central plant introduces maximum economy and efficiency in planning for future changes. Such alterations require only minor changes in the piping, and are accomplished with a minimum of time and expense.

Tenant "Psychology"

Psychology enters the picture at this point because of tenant reluctance to accept a central air conditioning system. The custom in the retail field has long been for the building owner to provide the heating, but for the individual tenant to provide his own air conditioning. The tenant's estimate of costs and the degree of control which he may have over the system are factors which have often influenced him to prefer the individual plant.

A central steam plant did not meet with too great opposition in the case of Northland, because many of the tenants for the retail units have long been accustomed to buying steam on a metered basis from the central heating system of the local utility, which services a large part of the downtown area. Retailers in this area are familiar with this type of service and metering, but those whose experience has been in neighborhood sites or other communities not served by central heating are more reluctant to accept the idea of buying steam from the landlord's plant.

However, a central air conditioning plant meets with much greater tenant resistance. The retail store operator is not yet ready for this step, though widening experience with installations of the type selected for Northland may make more ready acceptance of central air handling systems possible. An obvious difficulty is that of metering air flow, compared to the relatively easy task of metering steam and chilled water flow.

The engineering factors favoring a central plant were therefore disregarded for basically psychological reasons, and each tenant or each group of smaller tenants was given his own air handling unit, with steam and chilled water supplied from a central plant on a metered basis.

In future installations, it is expected that advantage can be taken of the possible economy and efficiency of an all-central plant installation, as tenant resistance diminishes. In such a central plant, the air conditioning outlets might be installed on flexible hoses (or in some other way) so they could be moved from one location to another when alterations were to be made. In contrast, to move an air conditioning unit means that changes must be made in the auxiliary services — refrigeration, steam, drain piping, and electrical wiring. The supply and return ducts, the air intake and the exhaust outlet may require changes, extending to the first floor and roof as well as in the basement. In contrast, major changes in a central plant system are made at a point remote from the retail store.

Architectural Advantages

Architecturally, the central plant offers important advantages. The mechanical system can be housed in one selected location and given landscape and other treatment that will happily complement the entire project in the optimum manner. In contrast, the individual development of separate plants in some 80 retail units presents an appearance that — however well planned and integrated — cannot be so pleasing. Individual chimneys, evaporative condensers, and cooling towers would be necessary on each unit, presenting a broken and unsatisfactory appearance. Moreover, as changes were made for successive tenants, changes in the paraphernalia on the roof-tops would be necessary, pyramiding the effect of confusion.

Northland — like most of the new major shopping centers — is located in a developing residential area of good quality. Pleasing architectural treatment is not only important in such a project for itself and its impact upon the patrons of the shopping center, but essential for maintaining the goodwill of the immediate community, whose residents naturally object to any undesirable or unnecessary commercial intrusion. The low height of the one story buildings used for all retail outlets except the major department store made this roof appearance of exceptional importance here.

Balancing all factors — economic, functional, and architectural — the decision was reached to use a central steam plant and a central refrigeration plant, supplying the steam and chilled water to each tenant.

The Boiler Plant

The boiler plant is 1100 ft from the shopping center proper, at a corner of the site. The structure is 130 by 120 ft, 27 ft high, of reinforced concrete finished in precast panels with metal frames, and masonry.

The initial installation consists of three 300 hp boilers, with a working pressure of 175 psi. The boilers are provided with forced draft fans and stub stacks.

This boiler installation is designed to take care of Stage I of the Northland project. The construction of Stages II and III will require two additional boilers of like capacity, or a total of five. The structure is designed so that additional boilers and refrigeration machines can be installed when needed without further building construction. No provision is made in this planning for the projected Stage IV, consisting entirely of residential construction.

The boilers are designed to be oil fired, but with provisions for conversion to gas firing when a suitable gas supply becomes available. There are four 25,000 gal underground storage tanks for oil. This is considered sufficient to provide

three weeks' supply of fuel in zero weather. The plant is designed for use of Bunker C oil.

3600 Tons of Refrigeration

The boiler plant also houses the refrigeration (two 1800 ton centrifugal machines) for the entire shopping center. Each of the units consists of two 900 ton compressors with a common chiller and condenser. Each of the paired compressors may be operated either separately or in tandem as desired. Future Stages II and III of the project will require the addition of two more 1800 ton units.

Condenser water is supplied by a cooling tower with a capacity of 24,000 gpm, designed for the future total load. At present, only 12,000 gpm will be used. This tower is 70 ft from the boiler house.

Steam Lines in Tunnel

The steam distribution system consists of underground conduit running from the boiler plant to the units in the shopping center. There is an 8 in. steam line and a 6 in. condensate return line. A single line is installed in each case, with no provision considered necessary for a standby line.

Unique in this installation is the positioning of the steam and condensate lines at the ceiling of the truck tunnel. This tunnel runs underneath all the buildings in the center, providing delivery and other service by truck right to each store, from this lower level. The incorporation of this feature in the design provided a logical place for the steam system, where it could be given maximum protection, together with easy accessibility at any point. This eliminated the need for a special utility tunnel system to service the project.

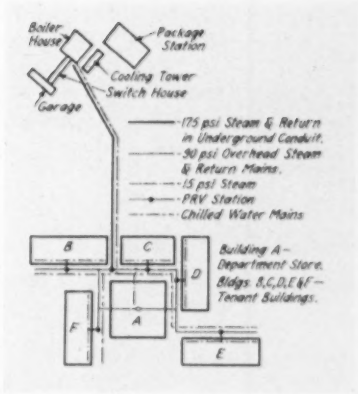
From this point, the steam lines are connected to the heating system and the air conditioning system of each store unit.

The chilled water supplied the stores is circulated from the refrigeration plant at the corner of the site through an underground conduit system using cast iron water pipe. The total length is approximately two miles, and pipe sizes vary from 30 to 8 in. diameter.

The initial circulation load will be 6000 gpm, with the future load planned at 12,000 gpm. The pumps were chosen so that load increments of 1500 gpm can be utilized, which corresponds to one-half the load of the refrigeration machines. (See HPAC, March 1953, page 112, for other details on the comparative size of this system.)

Panel Heating

The basic installation for the department store consists of a panel heating system located around the perimeter of the building, and the high pressure air conditioning system. The basic requirement of flexibility in design — which is essential in department store operation — governed the planning within the store as well as the basic plant selection. The problem of departments frequently changing and moving position within the store requires that the heating and air systems be designed to allow changes with maximum ease.

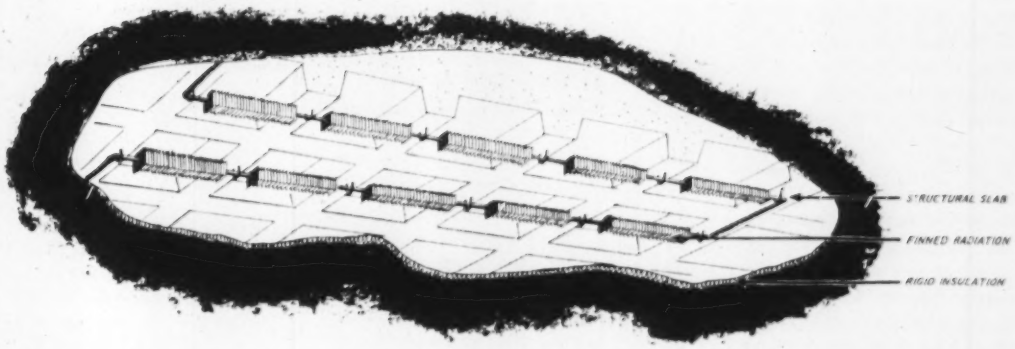


THE STEAM AND chilled water distribution systems. The steam line is 8 in. and the condensate return 6 in. Chilled water pipe sizes vary from 30 to 8 in.

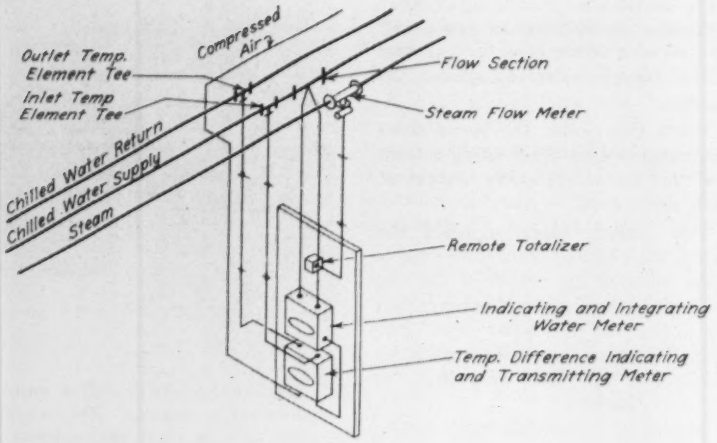
By the use of panel heating, the showcases and the walls can be shifted at will, without affecting the heating system.

Another innovation was adopted in the positioning of the panels. Because of the nature of the structural system used in Northland — a deep ribbed, two way reinforced slab — there was insufficient space to install pipes in the slabs. Instead, finned radiation was suspended below the structural slabs. This has been done in residential construction, but this is believed the first installation of its kind in a large building of this type.

Steam is metered for each tenant by means of steam flow meters. Rates are set upon a graduated basis, with the costs figured as cost of production plus a percentage fee for administrative costs. No charge is



PANEL HEATING, using finned radiation suspended below the structural slabs, is used for the perimeter of the department store



AIR CONDITIONING THERMS for each tenant's system are metered. This sketch shows typical steam and chilled water metering details

made for amortization of the steam plant, which is considered a customary obligation of the landlord to furnish. The net charges are calculated upon a cost basis, and no attempt to include an element of profit in the bill is made. This is considered as essential non-profit utility service.

High Pressure Air System

The high pressure air conditioning system was chosen for Northland in order to conserve ceiling space, as well as to provide the desired flexibility within the stores. The latter objective was achieved because the diffusers are on flexible hoses which can be shifted very easily. Because of the use of high pressure, the individual diffusers can be adjusted without unbalancing the entire air conditioning system.

The high pressure system operates at a static of about 7 in., and a 10 percent adjustment is a small part of the total pressure. In this way, the high pressure system leads to flexibility.

The Big Store

The apparatus for the major department store has some special features. It is located in a penthouse on the roof, unlike any of the other units, since this is a three story structure. It consists of eight 70,000 cfm units. Each has two fans, and separate reheating coils for each fan, so that the entire store may be divided into 16 zones. Each of the 16 zones is controlled by five thermostats, which provide an average controlling temperature.

Zoning is on an area basis rather than a department basis. Calculations showed that the only significant variable was the people load — the number of persons within the zone. A department could vary from 0 to 100 percent of people load — and the dry bulb temperature would vary approximately 4 deg as a result.

If normal operating conditions of 80 deg dry bulb and 50 percent relative humidity were maintained, this 4 deg temperature difference would be a serious factor to contend with. Therefore, the operating conditions for this installation have been set at 78 deg and 45 percent. With this reduced relative humidity, persons in the department will not be conscious of the 4 deg difference — and of course this is entirely hypothetical, since it is unlikely that there ever would be such a sudden change from 0 to 100 percent people load.

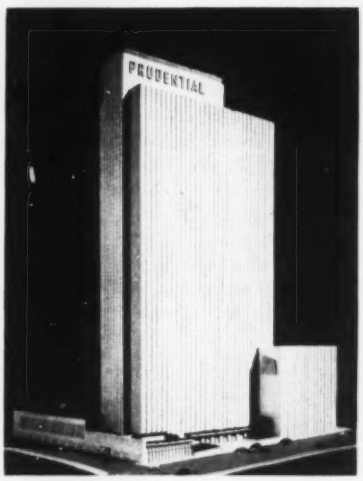
The owner installs the air conditioning system in each store unit for the tenant, providing a conventional type of system. Wherever possible, prefabricated air handling units are selected in order to keep down the investment cost.

In the case of the very small shops, which are mostly in a group at the ends of each of the five tenant buildings, a single air conditioning unit is utilized to service several shops, according to local conditions. Thus, although there are 80 tenant shops, there are but approximately 40 air conditioning units. These units have a total capacity of 1300 tons. The units themselves are in the basements of the individual stores.

Therms Are Metered

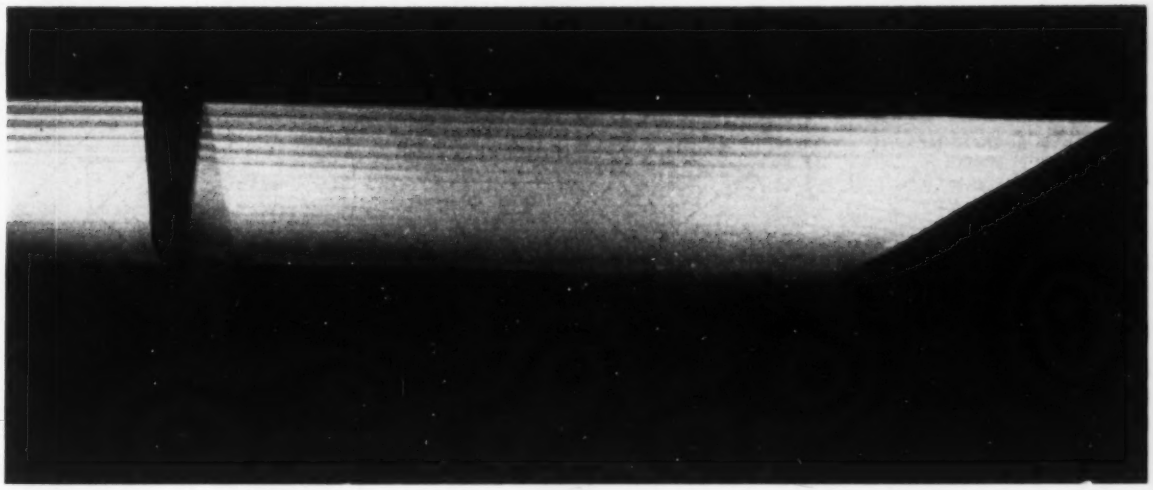
The chilled water supply furnished to each tenant's system is measured by an integrating type meter which reads directly in therms. The rates, like those for the steam, are graduated according to use, and based upon the cost of production plus a percentage fee for administrative expense. In this case, amortization of central plant is included in this cost, but again no profit element is included.

The architects and engineers are Victor Gruen Associated Architects and Engineers, Inc.; the associate engineer is H. E. Beyster, Inc.; the mechanical contractor is the Donald Miller Co; the general contractor is Bryant and Detwiler Co.; and the air conditioning contractor is Carrier Contracting Corp.



Completely Conditioned Prudential Building

The new Prudential Insurance Co. of America building, under construction on Chicago's lake front, will be completely air conditioned. The contract for the general construction of the 41 story, $37 million building was awarded last month to the George A. Fuller Co. This is a view of the architect's model. Naess and Murphy are the architects and engineers.



STEAM WAS ADMITTED into the plenum space to take photos illustrating the air distribution

Distributing Air from a Luminous Plastic Ceiling

Tests on air quantity, air velocity and noise are reported, with suggestions on applications

By Lawrence G. Seigel and W. L. Bryan

LUMINOUS CEILINGS — developed for effective lighting — also offer a method for air distribution which is particularly effective in air conditioning. The luminous ceiling described here provides good air distribution without drafts and combines this with high quality lighting and effective sound absorption. It is also attractive in appearance.

The results of air flow tests run on one type of luminous ceiling are described in this article. These tests indicate that this ceiling can be used as an excellent air distribution system and that it can handle large air quantities without excessive noise or drafts.

The authors are Associate Professors of Heat Power Engineering, Case Institute of Technology.

Description of Ceiling

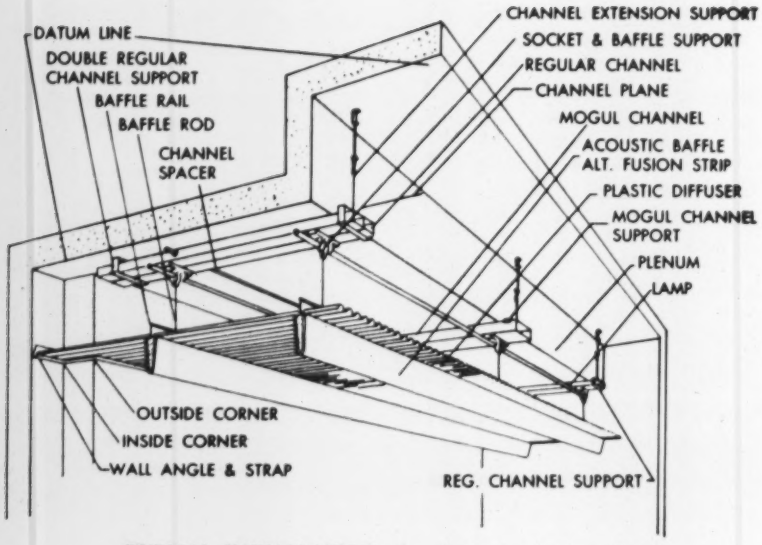
The ceiling tested was made of corrugated acrylic plastic sheets, each of them 3 ft x 4 ft, assembled between support rails which may also hold acoustical baffles for sound absorption. Air distribution from the ceiling is accomplished by leakage around the corrugated edge past the support rail into the room. Accurate spacing of the opening between the support rail and the plastic edge is maintained by means of an offset at the base of the rail.

For the purposes of the tests reported here, a 4 ft x 6 ft ceiling section was installed in a plenum 2 ft high to allow for the installation of two rows of fluorescent lamps above the plastic.

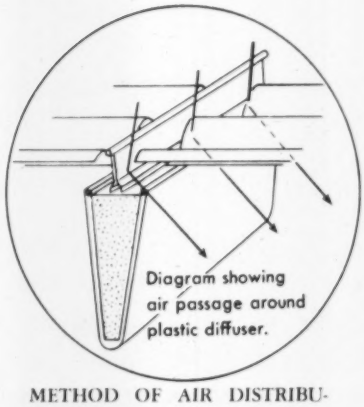
Test Set-Up and Procedure

The entire ceiling and plenum arrangement was constructed in a manner typical of a standard installation so that direct application of the results might be made in practice. Acoustical baffles were also installed at the support rails, as would be the case in a large office application.

Air flow was measured by a calibrated orifice using two sets of pressure taps and two independent calibrated draft gages for indicating the pressure drop across the orifice. Noise measurements were also made during the air flow tests so that a



TYPICAL INSTALLATION of a luminous plastic ceiling



METHOD OF AIR DISTRIBUTION from the ceiling is shown in this schematic drawing

record of the air flow vs. noise level would be obtained. Two different calibrated sound level meters were used for this purpose and the ventilating fan and motor were located at a distance from and outside the test space to minimize noise from those sources. The noise meter microphone was located at four different positions in a plane 30 in. below the ceiling and was shielded from the direct air jet in all cases. The average reading for these four positions for each rate of air flow was used in compiling the data given.

Air Flow, Noise, Velocity

The plenum pressures required to maintain various air flow rates from the ceiling are given in Table 1. The values in this table are expressed in cfm per ft of exposed plastic edge. There are two columns shown under the air flow heading in Table 1 because the capacity of the corrugated edge is greater than the straight wall edge. In fairly large rooms, the corrugated edge will be much longer than the wall edge and therefore, little error might result from using the air flow value for the corrugated edge as the factor for the total exposed edge. However, in the case of the smaller rooms, it may be necessary to consider both types of edge separately as indicated in the illustrative example under the table.

The results of the noise tests, also given in Table 1, are the averages of the values from the two instruments used to obtain the readings. Measurements were carried up to the point where a high pitched whistle was observed. This point is far beyond the range of operation of normal installations for ventilation or air conditioning. In fact, noise level readings in the range of normal air flow from the ceiling were so low that difficulty was encountered in obtaining reliable data. Even at very early morning hours, the background noise in the laboratory was 30 to 35 decibels. Therefore, the noise level due to air flow from the ceiling was difficult to determine accurately at low rates of flow.

In order to investigate the air distribution qualities of the ceiling other than by personal observation, measurements of air velocity were made at various distances from the ceiling. These readings were taken with a hot wire type velocity instrument, and therefore, were subject to the disadvantages common to such instruments.

However, it could be reliably observed that the air velocity was very high near the plastic edge, as would be expected; but this velocity was quickly reduced by entrainment and mixing, so that even at very high rates of air flow, no velocities greater than normal air movement in the laboratory could be observed more than 4 ft below the ceiling. At lower air flow rates, which would be normal for most installations, the edge discharge velocity was dissipated completely even closer than 4 ft from the ceiling.

Attempts were also made to determine the quality of the air distribution by taking photographs with smoke or balsa dust introduced into the air stream. These were unsuccessful. However, after considerable experimenting, satisfactory photographs were obtained by admitting steam into the plenum space at various rates of air flow.

TABLE 1— AIR FLOW AND NOISE LEVEL for luminous plastic ceiling

Plenum pressure, in. of H_2O	Air flow, cfm per ft of exposed edge: Corrugated edge	Straight wall edge	Noise level db
0.05	9.8	6.0	33
0.1	13.7	8.6	38
0.2	19.0	12.1	46
0.3	23.1	15.0	51
0.4	26.9	16.8	55

To illustrate the use of the table, assume that a room is to be conditioned with air distributed from 12 ft x 16 ft ceiling. In this application there may be eight corrugated edges, each 16 ft long and two straight edges, each 12 ft long. Assuming a plenum pressure of 0.10 in. of water, the air flow through the ceiling would be:

For the corrugated edges, $8 \times 16 \times 13.7 =$ 1750 cfm

For the straight edges, $2 \times 12 \times 8.6 =$ 206 cfm

Total for all edges ..... 1956 cfm

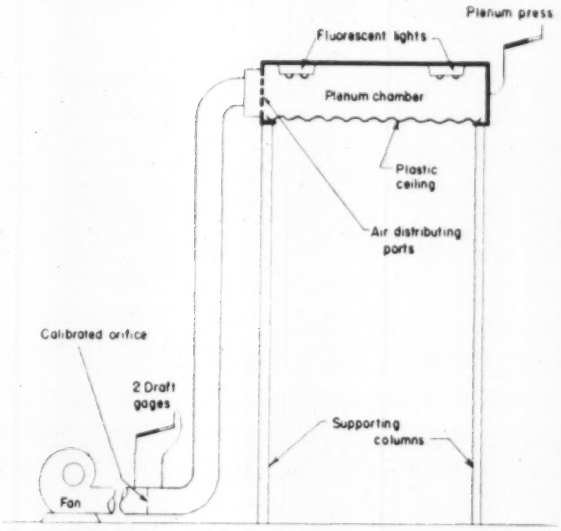
The Method's Advantages

Use of luminous ceilings for air distribution provides several advantages:

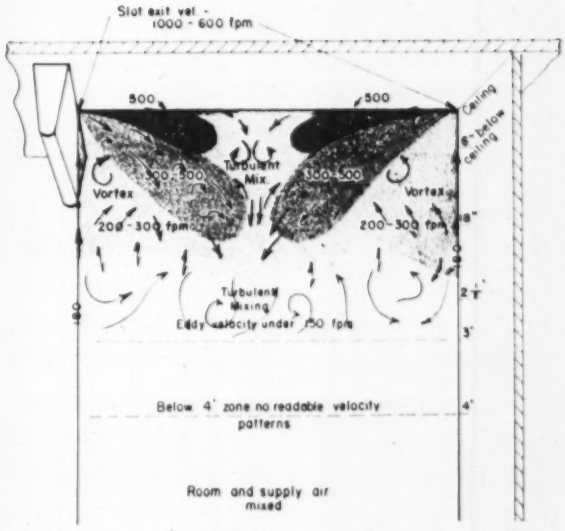
1) Large air quantities may be handled without noise or drafts.

2) The lighting heat load and transmitted roof or ceiling load may be absorbed before the air is actually introduced into the room. This permits higher temperature air to be supplied to the occupied space and further minimizes the effects of drafts.

3) Bare tube lighting fixtures may be used. This saves time and ex-



THE TEST SET-UP for investigating air flow and noise. The ceiling and plenum arrangement was constructed in a manner typical of a standard installation so that application of the results might be made in practice. Acoustical baffles were installed at the support rails, as in a large office application.



SCHEMATIC DIAGRAM drawn from actual velocity measurements taken below the ceiling at an air flow rate of about 12 cfm per sq ft of ceiling. This is an excessive flow rate (about four times normal) and the mixing zone ordinarily would be closer to the ceiling than indicated in the sketch

pense for the lighting installation. Much of the duct work otherwise involved is also eliminated.

To illustrate the effect of absorbing the heat load from the lights and ceiling before the air is introduced into the room, consider the results of one installation in an engineering department. In this particular case, the ceiling load and light load are high. With the installation of a luminous ceiling, it was computed that the summer conditioning could be done with air distributed from the ceiling at 74 F while maintaining 80 F in the room. Using the same cfm, another method of air distribution might require the air to be supplied to the room at 60 F. The higher air temperature is an advantage in reducing the possibility of drafts.

Further Study Desirable

The tests reported above indicate that a luminous acoustical ceiling of the type described here can be used to deliver an ample quantity of air for ordinary ventilation or air conditioning applications and neither air pressure drop (plenum pressure) nor noise level due to air flow will be excessive. Since the air is delivered to the room through many narrow slot-shaped openings at ceiling height, a rapid rate of entrainment and mixing is accomplished and the possibilities of drafts are minimized.

Further study is needed to develop this method of air distribution, especially as regards to the following items:

1) Dirt accumulation on the plastic. This problem has been studied as regards light depreciation [see Air Diffusion and Light Depreciation Tests of Luminous Ceiling, by Putnam, Waite, Seigel and Bryan, Illuminating Engineering, May 1952.] and no ill effects were indicated. However, these light depreciation tests were run under isothermal ventilation conditions, and therefore, the effects of thermal precipitation are not clearly known at this time.

2) Methods of zoning and control. These items are particularly important in large installations.

3) Methods of air return. Ceiling returns should be investigated and compared with floor returns.

4) Radiant heating and cooling. Definite though slight effects of radiant heating or cooling may be observed in systems using luminous ceilings. These effects should be investigated.

A test set-up is being prepared for the purpose of studying these items. It is hoped that the results of these investigations may be reported at a later date.

Outlines Methods for Reducing Motor Noise

ACCORDING TO Paul Richards, service manager of the Electro Dynamic Div., General Dynamics Corp., in a recent talk, there are three methods of treatment by which annoying sounds from motors can be reduced.

The first is to eliminate or reduce the basic cause: 1) reduce all sounds from the rotating parts, such as a fan on a rotor, or armature or a series of slot openings through which high velocity air is passing and chopping against a stationary part; 2) reduce sound of magnetic reactions on the motor frame coupled to the air through vibrating surfaces; 3) reduce unnecessary noises caused by bearings.

The second method is to reduce the coupling between the vibrating parts of the motor and the atmosphere or structure supporting it, he said.

The third method for reducing the sound level of electric motors is usually a problem for the architect and the acoustical engineer. If the offending installation is in a critical location or if floors, walls or ceilings tend to reflect sound, the installation of sound absorbent material or the complete isolation of the area with soundproof walls may be the only satisfactory solution, he said.

This Case Clears Up Some Cloudy Points About Mechanics' Liens

A CAREFUL PERUSAL of the following actual case — in which the names are imaginary — should serve to clarify some cloudy points with respect to mechanics' liens. Of extreme interest in this day of multiple building projects is the court's pronouncement concerning uses and deliveries of materials.

The C. Zun Heating Co. was chosen the subcontractor to furnish and install heating equipment for two allied groups of structures, Project A and Project B, comprising eight and 11 buildings, respectively. Zun contracted to buy the requisite materials from the Nosuch Co., which delivered what was needed for Project A between November 15 and July 24. For Project B, deliveries were made between November 16 and August 8. [The names are fictitious.]

Meanwhile, Zun ran out of funds and in May assigned to the Nosuch Co. all title to the money owed him by the general contractor. When September rolled around and Zun had not paid his bills, Nosuch served the agent of each project with a notice of intention to claim a mechanic's lien.

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Still no money was forthcoming. The now thoroughly disgusted Nosuch thereupon sued the project corporations for sums due and unpaid. The two suits were tried together before a chancellor, who entered a decree awarding Nosuch the requested liens.

Ruling Attacked

The defendant projects appealed from this decree. They attacked the chancellor's ruling on two grounds:

1) There was no sufficient evidence of delivery to the projects of the materials for which the liens were imposed. In this connection, the project corporations contended that most of the delivery tickets were receipted for by the Zun drivers "when they picked them up" at the Nosuch "place," and that the drivers could have hauled the materials to other jobs. It was therefore argued that a materialman should not be given a lien against a property owner merely because a subcontractor's driver had picked up the materials or because they had been delivered to a subcontractor employed on the owner's property.

2) Furthermore, said the defendant projects, Nosuch had not given either of them "timely notice of intention to claim a lien." Under this head the projects asserted that the great bulk of the deliveries were made before May 9. It was contended that in view of the C. Zun Heating Co.'s assignments made that day, the real purpose of subsequent deliveries was to extend the time for filing lien notice; and that the materials furnished after that date were therefore not furnished under the same contract as those furnished previously.

Rejecting the two grounds of defense, the state court of appeals conceded that the burden rested upon the Nosuch Co. as claimant to prove definite delivery of materials — several states having held that such materials must be actually used in construction of the subject building to become a basis for a lien thereon.

Judicial Trend

However, the court adopted the judicial trend observable in most states, which may be thus summed up:

1) A materialman who delivers materials to the construction site of several buildings comprising a single project does not have to show in which buildings the specific materials were used, or even that the materials were actually used on the project, in order to possess a valid mechanic's lien. Proviso: Such materials must have been purchased for the work and delivered at its site.

2) When there is no testimony to raise suspicion that materials purchased and delivered under contract were *not* used in the building, *it may be taken for granted that they were in fact so used* — especially when it is shown that *some* of the materials have been used in the construction. The courts presume, in the absence of direct evidence to the contrary, that all materials shown to have been shipped to the user were duly delivered to him.

3) Where materials are furnished for separate and distinct purposes, or under different contracts, the right to a lien must date from the time of furnishing different parcels of material and not from the last item in the account. This holds true, even though the materials were intended to be used by the contractor or builder in the same owner-contract. Nevertheless, where all *materials are furnished for the same general purpose* and are contemplated as one entire matter for settlement (as in the subject case) the *entire account should be treated as a single contract.*

4) After a contract is substantially completed, if the lien claimant does additional work or furnishes additional materials in good faith at the owner's request for the purpose of fully completing the contract and not merely as a friendly gesture, the time for filing the lien will run from the doing of such work or delivery of such materials, irrespective of value. The same rule applies to a notice of intention to claim a lien.

5) On the other hand, where the time for filing a mechanic's lien has begun to run, the claimant cannot thereafter extend the time by doing or furnishing small additional items — thereby fixing a date from which the lien notice period must begin to run anew. Especially is this true when the "real intention is to save or restore a right which is already imperiled or lost, or where the additional items are furnished without knowledge, request or consent of owner".

Materialman Wins

The appeals court exonerated Nosuch on these latter points and sustained him on the others. The materials delivered after May 9 were not "trivial items furnished solely" to extend the lien-time but, said the court, consisted of "pipes, flanges, ells, plugs, thermometers and other materials" valued at more than $2200. The last delivery was made on August 8. Nosuch served the required notice on each defendant project on September 11, "in compliance with the statute".

The chancellor's decree favoring Nosuch was affirmed by the appeals court, with costs against the defendant projects.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

QUESTION OF THE MONTH

• *IF YOU DON'T HAVE the answer to a heating, piping or air conditioning problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange."*

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

• *RECENT QUESTIONS have been asked about the specific advantages of air conditioning plant and office space, as such information is useful in justifying the investment in a proposed air conditioning installation. The following comments on this matter refer to an installation described in an article in the June HPAC.*

"Our Air Conditioning a Tremendous Asset"

THE AIR CONDITIONING system for our new office and factory buildings was a tremendous asset to us last summer.

Air conditioning in the plant is a year 'round asset, although its advantages during the summer months would more than justify its installation. Those familiar with this section of the country during the summer months can readily appreciate the conditions typical of this part of Iowa. High temperatures, supplemented by humid conditions, make working difficult during much of July and August.

Actually, air conditioning is not entirely new to the Sheaffer Pen Company. In line with our policy of providing the best working conditions possible for our employees, we have had air cooling systems not only in our main offices and factory but also in all of our other plants since 1937.

By providing pleasant working conditions within our offices and plants during the hot summer months, we have been able to maintain production schedules which otherwise might not have been possible.

An additional advantage we have gained through the installation of our new air conditioning system is better humidity control, which is vitally important in our plastic molding department. Unless the humidity is kept at a certain point, moisture is absorbed by the plastic molding powder. This results in an inferior structure and surface finish in the molded plastic pen barrels and pen caps.—W. F. HEISING, Vice President—Properties, W. A. Sheaffer Pen Co.

READER ASKS —

Two Different Qualities of Pipe Welding?

"At a meeting I attended recently, the question of possible different standards for welds in piping was discussed at some length. It was brought out that *perhaps* — because of competitive reasons — there should be one standard for welding piping such as low pressure heating lines, and another standard for welding high pressure piping such as is used in many industrial processes.

"Different opinions were expressed as to the desirability of this. Some felt that the idea of different standards should be adopted — while others said that there can be only one quality of pipe welding, and that it is just as cheap to make good welds as poor welds if the welders are properly trained.

"What do other readers of HPAC think about this?"—S. D. B.

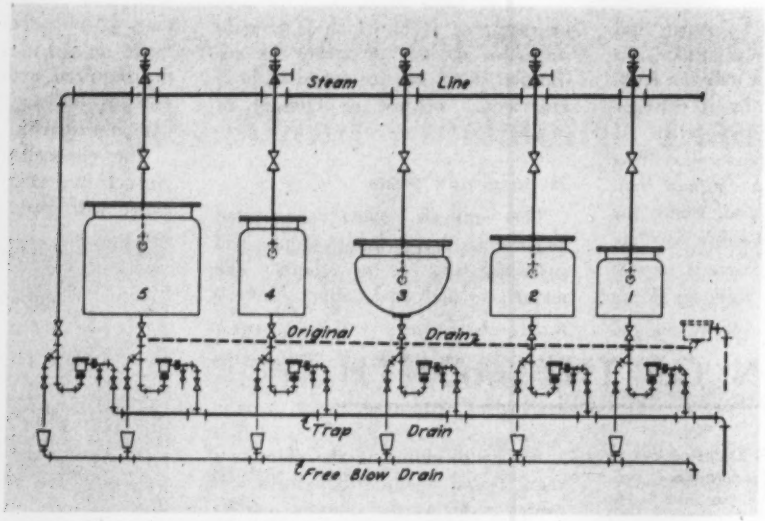
[You are invited to comment on this question, giving actual examples if possible. Address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2].

Quality Control of Stainless Steel Pipe

THE CHEMICAL INDUSTRY ADVISORY BOARD has discussed the finish of austenite stainless pipe, the American Standards Association reports. This pipe is used extensively for corrosion resistance and to avoid product contamination.

As defects in long lengths of pipe cannot be seen, it was suggested that the American Society for Testing Materials tentative standard specifications for austenite stainless steel pipe, for example, include information concerning defects that are cause for rejection and concerning permissible means for removal or repair of defects.

The board therefore sent recommendations to the ASTM that it consider adding quality control requirements to ASTM tentative specifications A312-51T.



"YOU WILL HAVE TO TRAP each of your kettles separately," said Mac. "Put a trap on the end of the steam line to keep it clear, too." (Swing check valve — not shown in diagram — to be in each trap discharge line)

"Short Circuits" in Piping

By Bill Dopp

. . . . cause trouble at a glue works, where five steam kettles are used. Changes in the piping and the traps will correct the difficulty

• *Almost anything can happen when you're in the engineering, operating, contracting or sales ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.*

Bill Dopp has had 40 years of experience dealing with piping, and including a long stretch of service as a sales engineer. He is devoting some of his present leisure to drawing on his many piping experiences, as he does in this story . . . .

"GOOD MORNING, Mr. Stanley. How are things going today?" Mac's cheerful smile was directed toward the lean figure of Joe Stanley, proprietor of the Stanley Glue Works, a newly organized enterprise.

"Not going at all, Mr. MacVane. Just about everything has gone wrong this morning. I won't have time to talk to you today." Clearly, Joe was agitated and worried.

"Perhaps I can help," suggested Mac. "What's the worst of the trouble?"

"I'm afraid this is out of your line. It's steam troubles we're having today, not packing trouble, Mr. MacVane." He didn't say so, but he meant "I wish you'd go."

Kettle Boiled Over

"It's Mac to you. What's the horrible smell?" Mac was holding his nose. "You must be cooking something rich, to create such an odor."

"It's rich, all right. We boiled over a whole kettle of glue. It seems that every time we get set to go something like this turns up." Joe sat down dejectedly. "I can't figure out what it is we do wrong. We had three kettles going fine. They're slow, but we finally got them regulated so that the small ones were cooking. All of a sudden the big kettle starts to surge and before we can turn off the steam it is over the top. What a mess!"

"Sounds like steam traps to me," remarked Mac. "They look simple but getting them to work right is not always so easy."

"We just put a larger trap on the

drain line when we added the last kettle. It should be able to take care of the whole row." Joe caught something in the look on Mac's face and added "You can't have a trap too big, can you?"

"Do you mean that you have all of your kettles draining through one trap?" Mac showed his astonishment. "No wonder you're having trouble."

"What's the matter with that? It's what the trap is for, isn't it?" Joe Stanley didn't like criticism, and showed it plainly.

"Wonder if you would let me take a look at that layout?" Mac wanted to help but was somewhat diffident about offering.

"All right," agreed Joe indifferently, as if to say "Take a look and get out. Can't you see I'm busy?"

They walked out to the factory. Down the line of five steam jacketed kettles of various sizes they went. Each kettle had a gooey liquid in it but the big one was really a mess. The glue had run all over the sides and on to the floor. A couple of men were trying to clean it up. As they approached, the big fellow stood up. "Mac," Joe said hesitantly, "this is Harry Dale, my assistant. Harry, this is Mr. MacVane. He thinks the steam trap may be stuck and causing our trouble."

"Not the way it's blowing steam and hot water into that tank, it isn't," opined Harry. "It's not the trap that's the trouble, I'm sure of that."

Trap Hookup Wrong

"The trap is working all right," said Mac, "but the whole trap hookup is wrong. It will never work this way. Let's go back to your office and I'll show you what I mean." The two looked at each other inquiringly and Joe nodded. Harry wiped his hands and folowed Mac. When they were seated, Mac made a sketch. "This is the row of five kettles, each with a steam line coming in near the top and a drain line from the bottom," he said. "Now, all of the steam leads come from one line and all of the drains are connected to another. Here's a trap on the end of the drain line."

"That's right," said Joe, "the trap drains into a tank we are using as a hot well for the time being."

Mac leaned back and eyed the two critically. "Let's get one thing established," he said. "Steam or water in a piping system will always follow the course of least resistance."

"Yes, but we've got these kettles," said Harry. "Are they like a pipe line?"

"For all practical purposes they're exactly like a pipe line," replied Mac. "As far as the handling of steam is concerned, the kettle is just an enlarged pipe. Then, too, you are using the kettle surface to condense steam, slowing up the flow until you change the steam into water." Mac was pointing to the various sized kettles. "Now these small pots will offer little resistance and as a consequence the steam will travel through them much more rapidly and tend to short circuit the larger ones."

Joe had a bright idea. "That is just like when you short an electrical connection."

"That's it," agreed Mac, "only it doesn't act exactly like the electric current. Instead of blowing a fuse, the larger vessels will sort of hang fire and hold the condensate in the larger space. This causes it to build up until you are heating with hot water instead of steam."

"That's why the little kettles would get so blamed hot, while we could hardly get the big ones warm. I can see that now." Harry had grasped Mac's thinking readily and began to enlarge on it. "So if you have all five of the kettles going, some of them will get hot and others will stay cold. I've had just that happen. Do we have to have all of them the same size?"

"We can't do that," interrupted Joe. "Every batch of our glue has to be made by itself. This is not like ordinary glue. We have a special process for the making of these glues that turns out a fine product. Up to now we have been making only small batches but things are getting to where we want to go into real production. We thought we were all set and the first batch jumps over the rim."

Here's What Happened

"You were doing the cooking, weren't you, Harry?" asked Mac. "Tell me just what happened. Let's mark these kettles No. 1 to No. 5, this way, so we can keep track of what we are talking about."

"I had No. 1 and No. 3 cooking when I turned the steam on the new one, No. 5," said Harry. "It was a long time even warming up. Then I turned the heat off No. 1."

"That's the smallest one," interrupted Mac.

"Yes. Finally, the big baby began to cook. When it got going, I turned off No. 3 so I could unload No. 1. I wasn't looking for trouble so I went ahead. First thing I know, the new kettle is steaming. Before I could turn off the steam, over she went. I darn near got burned reaching for that steam valve." Harry displayed some burned spots on his arm.

"The other two kettles were cold?" asked Mac.

"Yes," replied Joe. "We only used those for special glue. I'm beginning to see what happened. When Harry turned off No. 1, the big one got more steam. No. 3 was still short circuiting it so it heated slowly. Then when he cut out No. 3 there was only one path for the steam and she began to go to town. Harry didn't expect that, and the result is out there on the floor."

"That's just what happened," agreed Mac. "Your trap was working all right but the steam flow wasn't." He continued as he started another sketch. "When you drain more than one unit with a single trap, difference in pressure will stop drainage from the units with the higher resistance. You will have to trap each of your kettles separately."

"That will cost a lot," Joe worried.

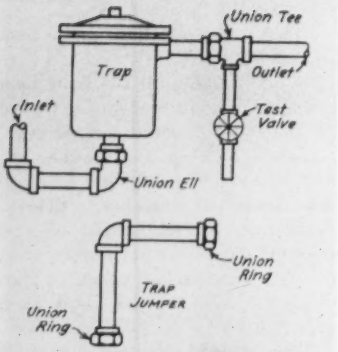
"Not so much," observed Mac. "Mind if I make some suggestions?"

"Gosh no," chorused Joe and Harry.

Rebuild the Steam Line

"If I were doing this, here is how I'd lay it out. In the first place, I'd take out that steam line and rebuild it like this." He pointed to the sketch. "Bring your separate leads out of the top of the line so as not to carry any condensate over into the kettles. Then put a trap on the end of the line to keep it clear. That way, you are sure of getting fairly dry steam at the inlets to your kettles."

"It seems to me that you have pretty big globe valves on this equipment," Mac continued. "One of the most common faults in installations of this kind is to get the throttle valves too large. This destroys the possibility of any close regulation of the steam."



"MAKE UP A JUMPER piece and rig up the traps so it can replace any one of them. Paint the jumper piece fire red and hang it on the wall. If Joe saw that red piece in a drain, he'd raise the dickens until the trap was fixed and put back."

"We do have to pretty near close those valves when we get to boiling," said Harry. "That little kettle has a ¾ in. valve and I have to watch it all of the time or it will do just what the new one did."

"That's right," agreed Mac. "It may take a few minutes longer to warm up, but you can get fine regulation with a small valve and not risk trouble. The next thing is to rebuild the whole drainage system. Put a separate trap on each of the kettles and get rid of that big trap. When you do that, look out — because these kettles are going to get hot fast."

"Can't we use that old one for the new kettle?" asked Joe.

"I'm afraid not, Joe," replied Mac. "It's often good practice to use a trap that will handle twice as much condensate as you are likely to get, but you can overdo that as you can anything else."

"That would mean we would have to have five traps for the kettles and another for the steam line. Six traps will run into money. Then you say change the steam valves. Holy smoke, Mac, we aren't made of money." Joe showed his reluctance about spending anything.

"Mr. Stanley," Mac said seriously," you are suffering from a very common ailment. Short sighted economy. Suppose you had a boil-over once a week, what would it cost you?"

"Plenty," answered Joe. "In fact, it would probably put us out of business."

"Now suppose that by doubling your output you could insure against that happening again. How long would it take you to pay for those traps and the new piping?"

Will Save Money

"If we could double our output by doing that, we might not have had to buy that new kettle. With that one and real production out of them all, we sure can go to town. I see your point. It's the old penny wise, pound foolish that you are talking about," said Joe.

"Right the first time," laughed Mac. "Now let's see how we work this out. Decide which trap you want to use. I'd make them all alike. Be sure to get the right size and orifice opening for each kettle. Buying these traps can be tricky. You can get into trouble doing even that."

"Seems you can get into trouble doing most anything in a plant," said Joe ruefully. "Then we can hook all of the drains from the traps into one line, can't we?"

"You sure can. To avoid some other troubles, put a sediment separator in front of each trap with a blowdown valve and leave it open to the atmosphere. Put a test valve just after the trap and a globe valve in the outlet line. Install the traps without a bypass. Those things can be the most costly items in your plant."

"How come?" asked Joe.

What About a Bypass?

"The purpose of the trap is to prevent live steam from escaping through the drain line. If you put a bypass around the trap, you put a premium on wasting steam. If the trap should stick or otherwise fail to work, it's so easy just to crack open that bypass valve and to forget the faulty trap. Fixing a trap is one of the things we like to put off until tomorrow." Mac was making another sketch while he was talking.

"What would you do then?" asked Joe.

"Install it like this," replied Mac. "Use a separator and an open blow from that. Put a tee beyond the trap and a test valve so that you can make sure that each trap is working. Have a gate valve under the kettle and a globe valve between the test tee and the drain line. Now, if your trap quits working you can close both these valves and service it."

"That means the kettle would be out while you monkeyed with the trap." Harry had been listening but now decided to take a hand. "With a bypass you could keep right on going."

"How long would it take you to break these two unions and insert an ell shaped piece of pipe like this?" asked Mac.

"Not very long if you had the pipe and everything handy. But how often can you find anything when you want it?" Harry voiced the old cry.

"Well, suppose you had this piece of pipe all made up and all of the traps rigged so that it would replace any one of them? Then we paint this jumper piece fire red and hang it on the wall where it would be handy any time you need it. If Joe saw that red piece in a drain he sure would raise the dickens until that trap was fixed and put back." Mac grinned at the thought.

"And how!" exclaimed Harry. "Say, that's a darn good idea. You ought to get a patent on that."

"No, Harry," Mac replied. "But I know one engineer who had to find seven out of ten bypasses in his plant cracked open before he adopted this scheme. Believe me, it can save a lot of money."

"Do you have to have a funnel on that blowdown?" inquired Joe, pointing to the sketch.

"You don't have to," answered Mac, "but it's a good idea. When you start up a unit, just open the blow valve and let the initial condensation flow direct to your receiver or hot well. Your kettle will warm up much quicker than if you let that load go through the trap. When you begin to get steam, close the blow and let the trap take over. With a funnel you won't have water all over the floor."

"You've given us some good ideas, Mr. MacVane, and I sure do thank you. We are going to use them and the next time you call I think you will find us in much better shape." Joe reached for the sketches as he spoke.

"Glad to help," replied Mac as he got up to leave. "Good luck, and I'll be seeing you soon."

Questionable Advice on Plant Piping?

P. I. PING SAYS — in his article in the August HPAC — that Martin MacVane's advice about the plant piping problem was questionable. Was he so eager to criticize Mac that he missed the point of the story?

The plant engineer, Herman Shultz, assumed that because his original line did not leak that he could construct the new one along what he thought were the same lines and get by. Mr. Ping's figures indicate that he raised the maximum bending stress at point C (shown in his diagram) about 16 percent.

It is interesting that Mr. Ping used as his method of arriving at his results a formula given in a report dated May 4, 1953. Suppose he had used some other method. Would his results have been the same?

You may recall that Mac told Herman, "There have been many investigators who have published data, but there still isn't complete agreement on how to figure stresses and anchor loads." So, Mac used the old cantilever formula — and was ultra-conservative, at that, in using the old stress of 8700 psi instead of the 14,240 psi used by Mr. Ping. Mac did slip when he said, "That's fine, we've got 1.4 in. to play with. We only need 0.8 in." He should have said only 1.2 in. This lapse has annoyed Mr. Ping, but it doesn't change the result.

Mr. Ping suggests the use of "judicious cold spring. Who is to say what judicious cold spring is?

Mac — faced with an actual situation — took a practical way out. He tried to impress upon Herman that these things are not simple. Mr. Ping's figures just confirm what he did. And he did cold spring the pipe — 50 percent; whether judiciously or not is for someone else to say.

No, Mac does not deprecate the use of scientific formulas and the latest available information. Nor does he want to take the place of the proper people to do these jobs. He does want to help where he can and he tries very hard not to give dubious advice. — BILL DOPP.

MR. PING REPLIES — This is sort of a rejoinder to Bill Dopp's rejoinder. As I noted, my remarks were "to set the record straight" and I emphatically do agree with the point of the story if, as I infer, it is that perfectly competent *operating* engineers may *expect* to make slip-ups in piping design and should therefore avail themselves of the services of experienced consulting engineers or obtain their piping from fabricators who have up-to-date engineering departments and who are willing to help out with a little design advice.

However, still for the purpose of putting the record straight, I continue to take exception to the way Mr. Dopp figures his cold spring allowance in computing line stress. There is 2.4 in. of actual expansion. The present Code for Pressure Piping says ". . . the maximum credit for cold spring shall not exceed one-third the computed total expansion." This gives 0.8 in. credit, which subtracted from the 2.4 in. actual expansion leaves 1.6 in. to be accommodated.

From this, I am inclined to question Mac's exclamation of delight when he says "That's fine, we've got 1.4 in. to play with." Trying to squeeze 1.6 in. out of 1.4 in. doesn't leave much room to play with. While the lapse certainly doesn't annoy me, it does seem to have some influence on the result in that Mac could hardly have reached the conclusion he did if he used the correct figure of 1.6 in. rather than the incorrect original figure of 0.8 in. or the incorrectly revised figure of 1.2 in.

I have enjoyed the stories about Mac which Mr. Dopp has contributed to HPAC's pages and hope to see many more. In a very entertaining way, they illuminate piping problems which arise in daily practice and they provide much food for thought in discussing practical solutions. It is principally because I am convinced of the value of this series of articles that I was interested in seeing the record set straight.

ASRE Hears Talks on Cooling

IN HIS PAPER ON a cooling tower selection chart and its application to field tests of cooling towers — given at the 40th semi-annual meeting of the American Society of Refrigerating Engineers — A. M. Norris, of the Baltimore Aircoil Co., said that methods for rating cooling towers needed considerable simplification. The chart he presented had been checked by field tests. The discussion brought out that the inherent design characteristics of cooling towers have much more to do with their performance than does anything else.

D. D. Wile, of Refrigeration Engineering, Inc., Los Angeles, presented a comprehensive paper on air cooling coil performance. He showed a graphical method for analyzing coil performance and selection, using the ordinary psychrometric chart. He stated that — as a result of his study — his preference for coil selection is the humidity method rather than the bypass method. Discussion indicated the method was very easy to understand.

Dr. C. A. Mills, of the University of Cincinnati, presented a paper having to do with tests on and experiences with the system of "reflective radiant cooling" installed in his home. The installation now has provision for bringing in outside air by a separate air handling system, which tempers the outside air in winter and dehumidifies it in summer. This, Dr. Mills said, appeared to be a necessary change in the system since he experienced high humidity the year previous when all cooling was done with radiant coils. Dr. Mills' paper drew very considerable criticism from the floor.

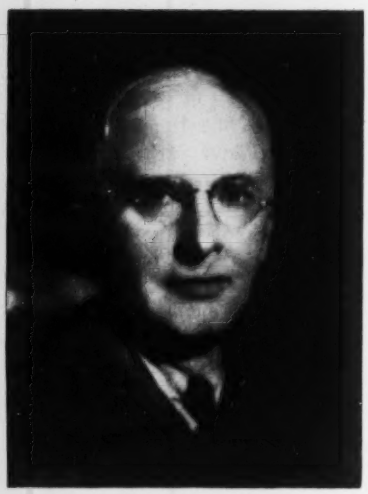
The technical requirements of air conditioning for Air Force installations do not materially differ from civilian applications, according to W. T. Smith, of the U. S. Air Force, Washington, D. C. He presented a method which is being considered for the determination of what locations warrant the use of air conditioning. The method involves climatic excesses in wet bulb temperature above a norm.

The packaged air conditioner conference was devoted to residential air conditioning.

The meeting was held at the Lake Placid Club, N. Y., and drew the largest attendance of any ASRE summer meeting. — H. J. PREBENSEN, President, Air Comfort Corp.

SAM LEWIS' PAGE

What Type of Heating for New Dormitory?



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

WE HAVE A question from a reader at a college, concerning the heating of a three story dormitory which is to be built. He lists several types of heating systems being considered, and asks about the advantages and disadvantages of each and their comparative overall efficiencies.

It is not necessary to write a text book to reply. The measure of overall efficiency — from cost of fuel to comfort within the student's room — is not a result of choice of any of the heating methods he asks about. Each of the schemes will warm a heat transmitter in a room. There may be wide variations in quickness of response, in the noise, and in the repairs, but other influences will make the choice wise or unwise.

Each of the schemes, for example, depends on adequate mixture of the fuel with air, and on the resulting hot gases of combustion being cooled by sweeping past the surfaces of the boiler, which surfaces in turn must be swept by the circulating water within the boiler.

Each of the schemes must bring the heat into the room to a surface warmer than the air in the room. The local air circulation around a heated object can make for dusty walls, local drafts and local too-warm spots, regardless of which system supplies the heat.

Each of the systems may be especially useful in some particular building and can be outstandingly undesirable in some other building of different occupancy. This building is to be a dormitory, where people live day and night.

A vacuum pump steam heating system — either upfeed or downfeed — is one of the methods being considered.

Whether the steam supply pipe comes down to the heat transmitter or comes up from below is of no consequence. In skyscraper office buildings, it is often convenient to place the steam supply mains in the attic, and to feed down through vertical pipes that are reduced in size as the burden decreases. The vacuum pump steam heating system always is two-pipe type.

The condensate outlet from each heat transmitter in the rooms must have a one-way flow valve that preferably will allow water and air to pass on their way to the vacuum pump, but that will prevent passage of steam, and also will prevent any reverse flow from the return pipes into the radiator.

It is possible, with a vacuum pump system, to modify to some extent the temperature of the surface of the heat transmitter by varying the opening of the supply valve. This ability to suit the heat output to the need has been found to achieve fuel economy, since with a gravity steam heating system the tendency is to open the window to waste surplus heat rather than to close the steam valve at the radiator.

It is to be observed that all steam heating systems must have means of removing the hot water that condenses when the steam loses heat. A condensate pipe or return must drain every radiator. Often this return pipe must be placed above the floor along the outside wall, or must have a trench or pipe-way below the floor.

Our reader's question about heating the dormitory also suggests the use of warm water pipes embedded in the floors or ceilings, the warm water being circulated constantly by a pump.

With such a system, no radiators or heat transmitters are visible in the rooms. The radiant pipes and the masonry around them, as well as the water within them, respond slowly as the temperature changes. If a person can reach a valve and if he closes this valve, several hours may pass before any noticeable reduction in the room temperature will occur. If the occupant of a radiant heated room wishes to sleep with a window open, several hours must pass after the hot water supply valve is closed before the room becomes cool, and the early morning riser must dress in chilly air, even though he closes the window and opens the valve.

Radiant hot water heating is excellent for many types of applications, and I have used it widely. It is serving nicely in many hospitals, for example. I would not go out of my way, though, to install it in a student dormitory.

Hot water, circulated by a constantly running pump, may of course be employed for heating the dormitory by another method. In each student's bedroom would be a hot water radiator below the window, each with a control valve whereby the temperature may be regulated to suit the individual need and hour.

The flow and return mains may be overhead or in the basement, though with hot water there is no necessity for pipe trenches below the floor.

Experience over many years shows that the fuel cost with heat transmitters having variable temperature generally is at a minimum.

DATA SHEET

Important Considerations in

Selecting Industrial Pumps

What To Tell the Pump Manufacturer

By Melvin Mann
Assistant Design Supervisor
Peerless Pump Div.
Food Machinery and Chemical Corp.

IT IS THE DESIRE of pump manufacturers to give the best service possible to their customers, safeguarding the customer from faulty assumptions in pump selection and making sure that the optimum pump selection is made for each application. Obviously, a manufacturer cannot know the many intangible factors which are sometimes at work on a given application. Only with complete information can the manufacturer properly analyze the problems and ultimately make the best possible selection for a given situation.

Economic Reasons

It is the manufacturer's desire to offer the optimum unit, design-wise and performance-wise, consistent with the practical and economic factors which enter into the selection. For example, the optimum selection from the application standpoint might be a six pole or eight pole pump speed, but for economic reasons or reasons of initial price, perhaps a four pole pump would be satisfactory. Here it is important for the buyer to give the manufacturer an idea as to what is his predominant thinking. This is also the opportunity for the manufacturer's representative to point out to the customer the advantages of the optimum unit when long-range economic factors of operational efficiency and lowered maintenance costs due to lower speeds, for example, are apparent.

If, however, first price alone is the primary consideration in the mind of the customer, this should be clearly explained to the manufacturer so that he will not spend unnecessary time on the other selection factors, which would ordinarily be regarded as important.

On many requests for quotations, all the important conditions are not described. This obviously results first in delay in the quotation, but what is more important, it can be directly responsible for future operational trouble, due to mis-application. Preliminary information which is complete in all its details is most necessary. This is especially true where the liquid to be handled is other than water.

Fluid Characteristics

The following fluid characteristics should be carefully determined and submitted to the pump manufacturer:

a) *Commercial designation* and, if possible, chemical designation of the liquid.

b) *Concentration of liquid* expressed either in terms of its absolute chemical concentration or perhaps in some commercial scale, such as Baume' or specific gravity.

c) *Vapor pressure* of the liquid. It is important that this be determined at the outset and agreed upon for the particular conditions. When in doubt about the vapor pressure, do not guess at it, but take particular precautions to determine this very important factor. A corollary of this is the determination of the available NPSH in the system.

(NPSH (Net Positive Suction Head) is defined as the total suction head in feet of liquid absolute, determined at the pump suction nozzle, less the vapor pressure in feet of liquid absolute. Where the buyer is not certain of how to calculate the NPSH available, a complete description of the suction system should be furnished the manufacturer so that this important item can be determined.)

d) *Pumping temperature* should be clearly stated; if it's over a range of temperatures, be sure to state the maximum and minimum temperatures which will be involved in service.

e) *Viscosity* at the pumping temperature. This should be stated clearly in conventional terms of some accepted standard viscosity scale.,

f) *pH or other chemical properties* which are known or can be presumed (on the part of the customer or prospect) to prevail. For example, in some chemical solutions, "impurities," while a very vague term, generally leaves the ultimate properties of the solution an unknown factor to the manufacturer. If the "impurities" constitute only a minute part of the solution, then it should be determined whether these minute percentages will have an effect on the pumping conditions. Furthermore, the basic nature of solids in suspension should be described, if possible. For instance, some solids in suspension have very little abrasive quality (such as talc) while others (such as silica compounds), even though in small quantities, would have damaging effects on pumping and piping equipment.

g) *Finally, the customer* or prospect frequently knows from his own experience what materials are best suited for the job under consideration. His counsel should be relied upon to a great extent.

It is not good practice to rely solely on the nomenclature of an individual industry. For example, "fuel oil No. 5" may mean a great deal to a refinery man in a given area. "Fuel oil No. 5" may mean quite a different thing to some other oil company, and if all terms are not properly defined, the pump manufacturer cannot always be expected to make the best recommendation for the conditions.

Operating Conditions

All too frequently, from preliminary information received by the pump manufacturer, it could be assumed what the head-capacity relationship is for a fixed point only. This is practically never the case in actual operation — particularly in industrial applications. The normal percentage of error in figuring system head losses due to friction, elbows, bends and variations in capacity greatly influences the operating conditions to which the pump will be subjected. Therefore, it is well to gather and submit as much information as possible regarding probable variations in head and capacity. If desired, and given sufficient information, the manufacturer's engineers can plot the system head curve on request. This helps further to define the operating conditions, for the protection of the customer and to give the best service possible by the pump manufacturer.

External factors frequently restrict the application safety factors to minimum limits. Therefore, it is not unusual to find adverse conditions, after the pump is finally installed and is in operation. The most frequent manifestations of this are:

a) *Motor overload* on centrifugal pumps where the actual operating head is considerably lower than the pump was designed for.

b) *Bearing trouble* on close coupled turbine type pumps operating at heads much lower than the design head, so that a continuous up-thrust load prevails. On all application problems involving close coupled vertical turbine pumps (50 ft or less) particular attention should be given to the operating conditions that are likely to prevail in service.

c) *Cavitation, erosion* and eventual destruction of pumps due to operation at heads lower than specified and thus capacities greater than specified.

One of the most frequent erroneous assumptions made is the "flooded suction" assumption. What is flooded suction? It may mean that the suction has a head of 100 ft or more on it. If not otherwise defined, "flooded suction" is a meaningless term by itself and it behooves all concerned to be acquainted with the facts relating to suction conditions. This is equally true whether the liquid is water, hydrocarbon compound or a complex chemical compound.

On many of the high capacity vertical turbine pumps and all mixed flow pumps, marked increases in heads over the design head can result in operation at an undesirable spot or dip in the head-capacity curve. This results in a severe loss of performance for both types of pumps, as well as an appreciable increase in horsepower in the case of mixed flow and axial flow pumps, particularly. This is related to the previous precautions mentioned in reference to the head and capacity range which are likely to be encountered.

Piping Layout

Summarizing the foregoing, it should be obvious that for the best application it is further necessary to define completely — insofar as possible — the head-capacity ranges which are likely to be encountered, and the suction and discharge lines — particularly where complex systems are involved. All available information on the physical and chemical characteristics of the liquid should be submitted.

It seems apparent also that consideration should be given to the most adverse circumstances under which the system could possibly operate. For example, is there a possibility that the system could be completely isolated by closing valves on both sides of the pump in operation? If this is a possibility, it should be pointed out in the preliminary information.

Finally, field experience and observations as to materials used in pumping equipment for various chemical solutions should be recorded. This will help the pump manufacturer in recommending the proper equipment for similar problems encountered elsewhere.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Design and Performance of a Residential Earth Heat Pump

By Merl Baker*, Lexington, Ky.

SUMMARY—A discussion of the design procedure of a residential earth heat pump is presented together with performance data for the 1950-51 heating season. The Ingersoll-Plass, Binder-Schmidt and relaxation methods were employed in the design of the earth heat exchanger. The nine-room well-insulated house in which the heat pump is installed contains a volume of 16,000 cu ft, and has a heat loss of 48,000 Btu per hr based on 70 F inside and −5 F outside. It is located at Hopkinsville, Ky., approximately 37 deg N latitude, elevation 524 ft. Performance data during the 1950-51 heating season, 4327 degree-days, reveal that the house was heated by an electric consumption of 3628 kwhr, and that the operation was satisfactory at a minimum outside temperature of −22 F.

IN SELECTING a heating system for a residence, the owner is usually vitally concerned with (1) dependability, (2) flexibility, (3) cleanliness, (4) cost of installation, and (5) operating cost. He would like to receive maximum advantage of the first three factors and simultaneously keep the latter two as low as possible. In order to select the best system for a particular buyer, the heating engineer is confronted with a difficult problem in that local conditions may greatly influence the desirability of his choice.

The factor of cleanliness was very important in choosing a heating plant for the residence reported in this article. Coal-fired equipment was eliminated as the owner felt that soot would be detrimental in defacing the white shingles of the new house. Natural gas was not available at the location and predicted installation and operating cost for oil-fired equipment was unfavorable. The operating cost of an electric resistance system was discovered to be extremely great even considering the very satisfactory electrical rate in the locality.

The use of a heat pump was considered because no one conventional system seemed to meet the heating requirements satisfactorily. An analysis proved favorable in every respect except for the initial cost. A further consideration revealed that since the heat pump could both heat and cool the house, it would be justifiable to charge only a part of the initial cost to heating and to allow the remainder to be absorbed as the luxury of cooling. Accordingly, the heat pump was selected as the most desirable system for the application. The next problem confronting the designer was the choice of the heat source, with the possibilities being well water, the earth, and atmospheric air. The latter source was eliminated when a check of U.S. Weather Bureau records revealed that during the past 10 years there had been several days with a minimum temperature between −10 and −20 F. As a water well did not exist on the property, an embedded earth coil was selected as the most suitable heat source for this particular heat pump.

Description of Installation

Conditioned air is supplied to the rooms of the house (shown in Fig. 1) by a forced circulation system. The air conditioning coil transfers heat between the circulating air and the charge (dichlorodifluoromethane) of the refrigeration system, and serves as a condenser for winter operation and as an evaporator for summer operation. The other major heat exchanger of the refrigeration system consists of five coils of $\frac{5}{8}$-in. O.D. tubing connected in parallel and immersed in a 1000-gal storage bath of antifreeze solution (Fig. 2). By

*Associate Professor of Mechanical Engineering, University of Kentucky. Junior Member of ASHVE.

Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Denver, Colo., June 29-30, July 1, 1953.

Fig. 1—The residence in which the heat pump is located

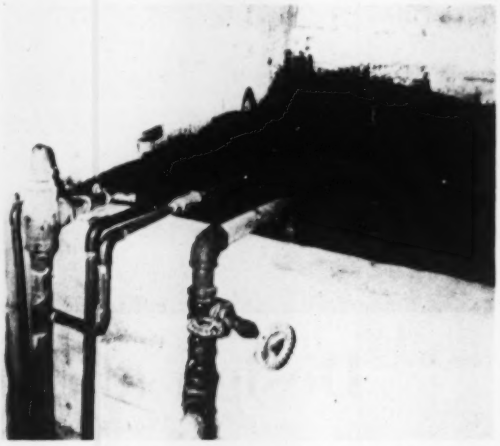


Fig. 2—Antifreeze storage tank and direct expansion coils

use of appropriate conversion valves the immersed coils serve as an evaporator and condenser for winter and summer operation respectively. Heat taken from or given to the storage bath is ultimately transferred to the earth by circulating the fluid through an embedded coil.

The earth coil consists of three parallel circuits of ⅞-in. O.D., type K copper tubing with an aggregate length of 480 ft. The average depth of burial is 6 ft below the earth's surface, and the spacing between coil sections is approximately 8 ft. Figs. 3 and 4 show, respectively, the antifreeze circulation pump and thermometer wells in the headers at entrance to, and exit from, the earth heat exchanger.

The refrigeration compressor, 5 hp driving motor, ¼ hp circulating fan, air conditioning coil, conversion valves, and auxiliary refrigeration equipment are located within a closed plenum chamber shown in Figs. 5 and 6. The fan draws air at room condition into the chamber through the return duct system and discharges it through the conditioning coil into the distribution system shown by Figs. 7 and 8. Conversion from winter to summer operation is achieved by means of a valve system which reverses the function of the two major heat exchangers. The circuit diagram of the refrigeration system is shown in Fig. 9.

Operating Conditions

The nine-room well-insulated house, in which the heat pump is installed, contains a volume of 16,000 cu ft, and has a heat loss of 48,000 Btu per hr based on 70 F inside and −5 F outside. It is located at Hopkinsville in southwestern Kentucky, approximately 37 deg N latitude and 524 ft elevation. The annual mean temperature for the locality is approximately 55 F, with expected

Fig. 3—Antifreeze circulating pump

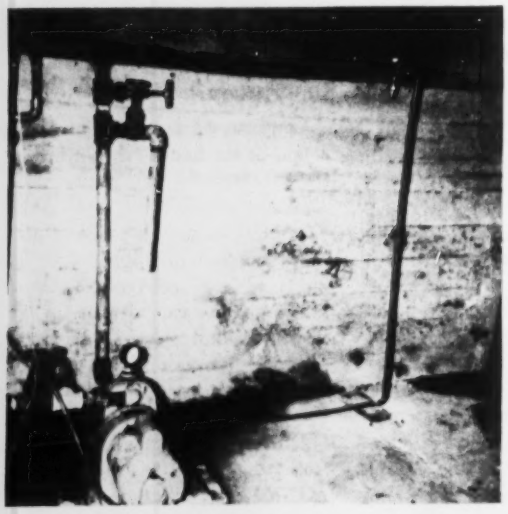


Fig. 4—Thermometer wells in the antifreeze lines entering and leaving earth coil

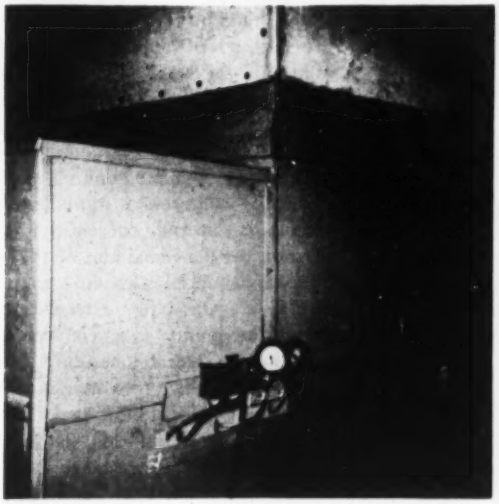


Fig. 5—Heat pump unit together with pressure controls and gages

Fig. 6—Heat pump unit showing some of the conversion valves

summer and winter extremes of 100 F and −10 F respectively.

The equipment was combined to provide a refrigeration unit having a rated heating capacity of 53,000 Btu per hr at an evaporator temperature of 10 F, and a supply air temperature of 105 F. It is evident that if the coil length were increased to allow adequate heat absorption at a higher evaporator temperature, the required displacement of the compressor would be less. An evaporator temperature of 10 F is a design value only. Operation normally proceeds at considerably higher temperatures. The temperature of the supply air was determined by an economic consideration of the first cost of the fan and air conditioning coil and the operating cost of the refrigeration plant as influenced by head pressure.

The thermal capacity of the 1000-gal antifreeze storage bath permits operation at a high average suction temperature, a factor conducive to good efficiency. A time delay switch allows the circulation pump to operate longer than the compressor thereby reducing the instantaneous rate of heat transfer between the antifreeze and earth. Only during continuous operation at the design load would the rate of heat transfer between the antifreeze and earth be as great as that between the refrigerant and the antifreeze.

The air temperature within the house was controlled by a central thermostat located in the first story and connected in series with the starter coil of the compressor motor. Room temperatures were satisfactory. Since only two people normally occupied the house, registers to two of the rooms were sometimes closed. The heat actually supplied by the

Fig. 7—Plenum chamber and ducts

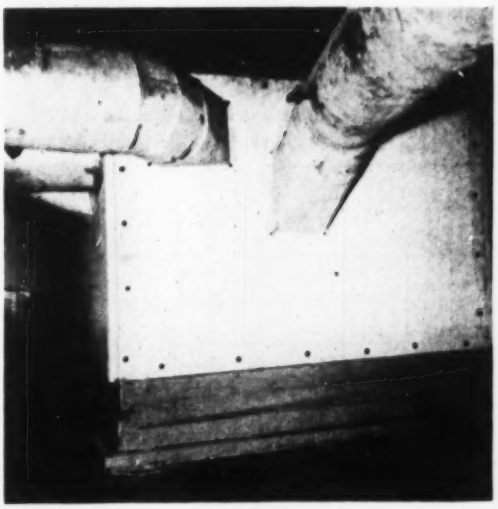


Fig. 8—Plenum chamber and trunk duct system

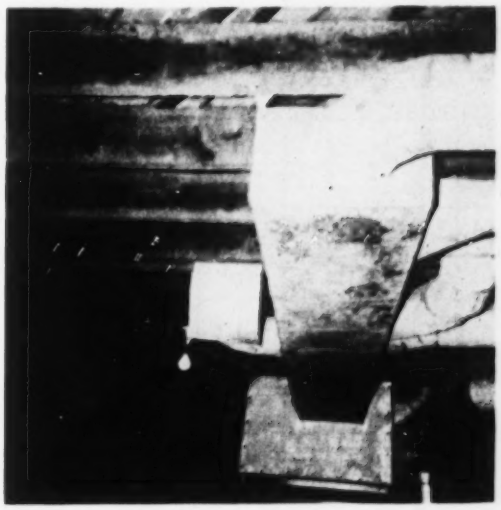
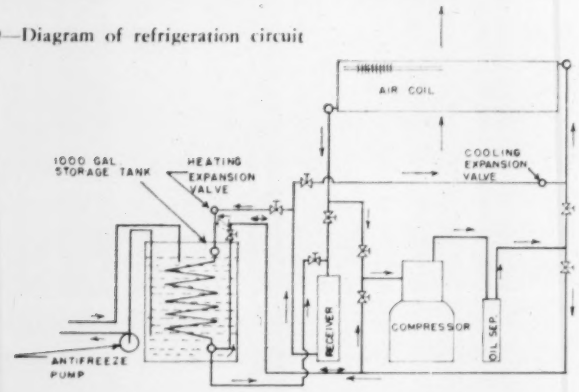


Fig. 9—Diagram of refrigeration circuit



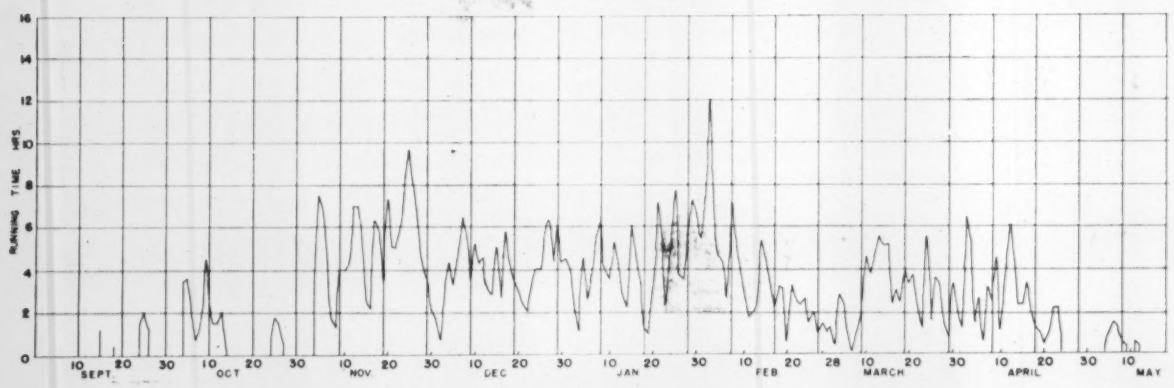
plant during the 1950-51 heating season was only 63 percent of that estimated by the degree-day method. The decrease below calculated values, while partially due to the reduction in heat supplied to two of the rooms, was also due to snow on the roof, Venetian blinds, and good weather stripping.

Performance During 1950-51 Heating Season

An electric clock was connected in parallel with the compressor motor to indicate daily running times. The plant ran most frequently between 10 p.m. and 9 a.m., thus producing a favorable load as viewed by the electric company. An electric power meter was used to measure the combined input to the compressor and fan motors. By recording the suction and discharge pressures, the hourly rate of heat absorption by the evaporator was determined from the manufacturer's data. The product of this rate and the actual operating time added to the electrical input gave the heat delivered to the building. Radiation and convection loss from the air distribution system were not charged against the heat pump. The daily time of operation throughout the season is shown in Fig. 10.

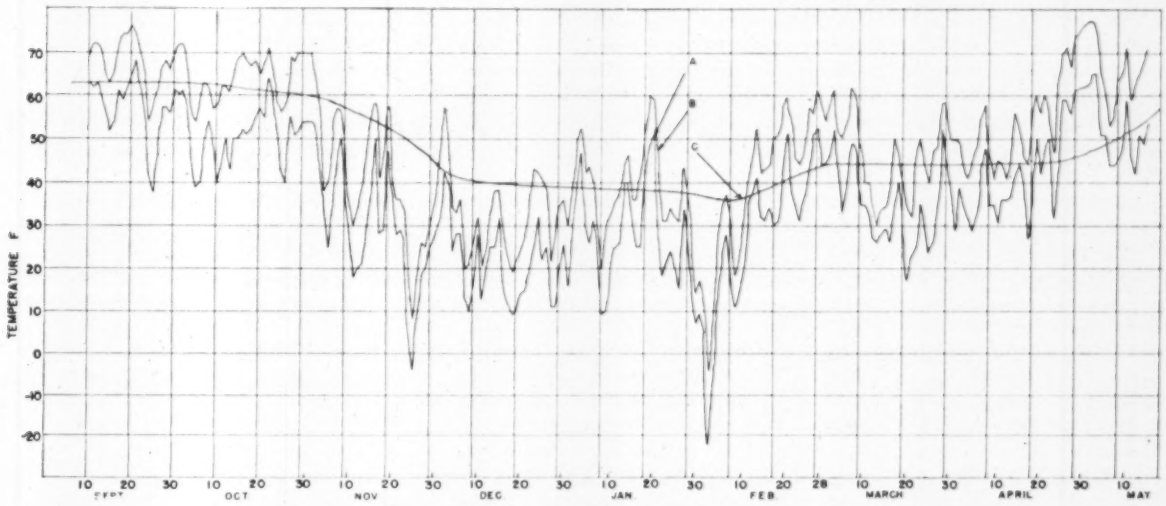
Calculations indicated that the 1000-gal evaporator storage tank would have to be supplied with sufficient antifreeze to enable operation at a temperature of approximately 15 F. Water was used as late in the heating season as possible in order to extend the test period for tank leaks. About mid-November, ice was forming on the outside of the immersed coils while the temperature of the water in the tank ranged from approximately 45 to 55 F, fluctuating with the operative cycle. The ice, however, readily disappeared when the compressor was stopped and the build up during the running cycle was not significant.

Fig. 10—Operating time of unit



On November 25, when the outside air temperature dropped to −4 F, ice formation required stopping of the plant for a few minutes to allow de-icing of the coils, after which normal operation was resumed. The installation of a larger capacity circulating pump, running longer than the compressor minimized ice accumulation and, consequently, operation for the remainder of the winter was achieved with only water in the tank. On a few extremely cold days the pump ran continuously. The mean water temperature of the tank throughout the winter is shown in Fig. 11, which shows that a minimum temperature of 36 F was reached about February 8 after which it began to rise. Ice formation was the most severe during the early part of February while the tank bath was the coldest, but even then the insulating effect rarely forced the suction temperature of the refrigerant below 17 F.

By observing the temperature of the water returning from the earth coil at the start of the circulating pump (measured by a mercury thermometer inserted within a thermometer well in the return line) an approximation of the soil recovery temperature was obtained. Table 1 shows the comparison between the approximate recovery and the calculated undisturbed soil temperature, together with the average heat abstraction during the period. The favorable comparison between the recovery temperature and calculated undisturbed temperatures is of great value to the designer. Precipitation



Temperatures: A = Minimum outdoor; B = Mean outdoor; C = Storage tank

Fig. 11—Temperature of outdoor air and storage bath

above normal occurred during the year and much of it was in the form of snow. The prediction of the insulating effect of the snow which began in November and extended intermittently into April was difficult. During a considerable portion of the period the ground was blanketed with snow to depths ranging up to 1 ft. Comparative performance data and weather conditions are shown in Fig. 11 and Table 2.

Discussion of Test Data

The somewhat limited data reported in this article are not intended to represent a complete engineering test, but to serve the important role of evaluating the performance of a heat pump system under actual operating conditions. From the data presented, the performance of the earth heat exchanger may be evaluated accurately together with the efficiency of the plant and cost of operation. A discussion of a complete engineering test is given in previously published material.[1,2]

The results of the 1950-51 heating season test indicate that the earth heat exchanger was adequately sized for the demand and that the short term maximum heat abstraction rate (determined from the design heat loss) is the critical design load factor. However, at abstraction rates considerably greater than encountered in this test, the progressive decrease in the temperature of the earth produced by the continuous removal of heat may prove more significant. A recovery record similar to the one reported in this analysis, Table 1, was observed by Penrod and associates for an approximate average absorption rate of 15 Btu per (hr) (ft) and a cycle of 12 hr operative and 12 hr idle.[3] From their report maximum recovery temperatures from November 1 through May 1 for the tube surface and a point 18 in. below were:

Month	Temp of tube surface F	Temp point 18 in. below tube (6 ft below surface) F
Nov. 1	63	63
Dec. 1	51	55
Jan. 1	46	50
Feb. 1	43	43
March 1	42	46
April 1	42	44
May 1	44	46

The favorable comparison between results of short term and seasonal tests was also reported.

The Ingersoll-Plass, the Binder-Schmidt and the relaxation methods, all approximate, are very valuable in predicting the performance of a coil embedded in the earth. An observation of the slope of the temperature distribution curve in the proximity

Table 1—Earth Heat Exchanger Data, 1950-51

Month	Ave. heat absorbed, (Btu/(hr)(ft)	Observed approx recovery temp F	Calculated undisturbed temp F
September 1950	1.7	63	64
October 1950	3.7	61	62
November 1950	17.6	58	58
December 1950	15.4	52	54
January 1951	16.4	44	49
February 1951	12.3	42	46
March 1951	10.7	44	46
April 1951	7.8	46	48
May 1951	1.5	50	52

Table 2—Performance Data, 1950-51

Month	Running Time Hours	Heat taken from earth[a] Btu	Heat delivered[b] Btu	Electric energy consumed: Compressor and Fan kwhr	Electric energy consumed: Total[c] kwhr	Heating Energy Ratio	Precipitation Normal In.	Precipitation Actual In.	Degree-Days
Sept. 1950	7	292,000	429,000	40	43	2.92	3.1	6.5	28
Oct. 1950	29	1,270,000	1,837,000	165	180	2.99	2.8	1.6	75
Nov. 1950	140	6,100,000	8,570,000	750	824	3.04	3.8	5.7	755
Dec. 1950	122	5,320,000	7,560,000	655	719	3.08	3.7	2.5	994
Jan. 1951	130	5,680,000	8,180,000	729	797	3.00	4.2	10.5	845
Feb. 1951	91	3,970,000	5,550,000	470	518	3.16	3.7	4.2	688
March 1951	85	3,710,000	5,280,000	457	501	3.08	5.0	5.4	571
April 1951	61	2,660,000	3,790,000	330	362	3.07	4.4	4.0	351
May 1951	6	262,000	368,000	32	35	3.07	4.1	0.6	42
					Average	3.05		Total	4337

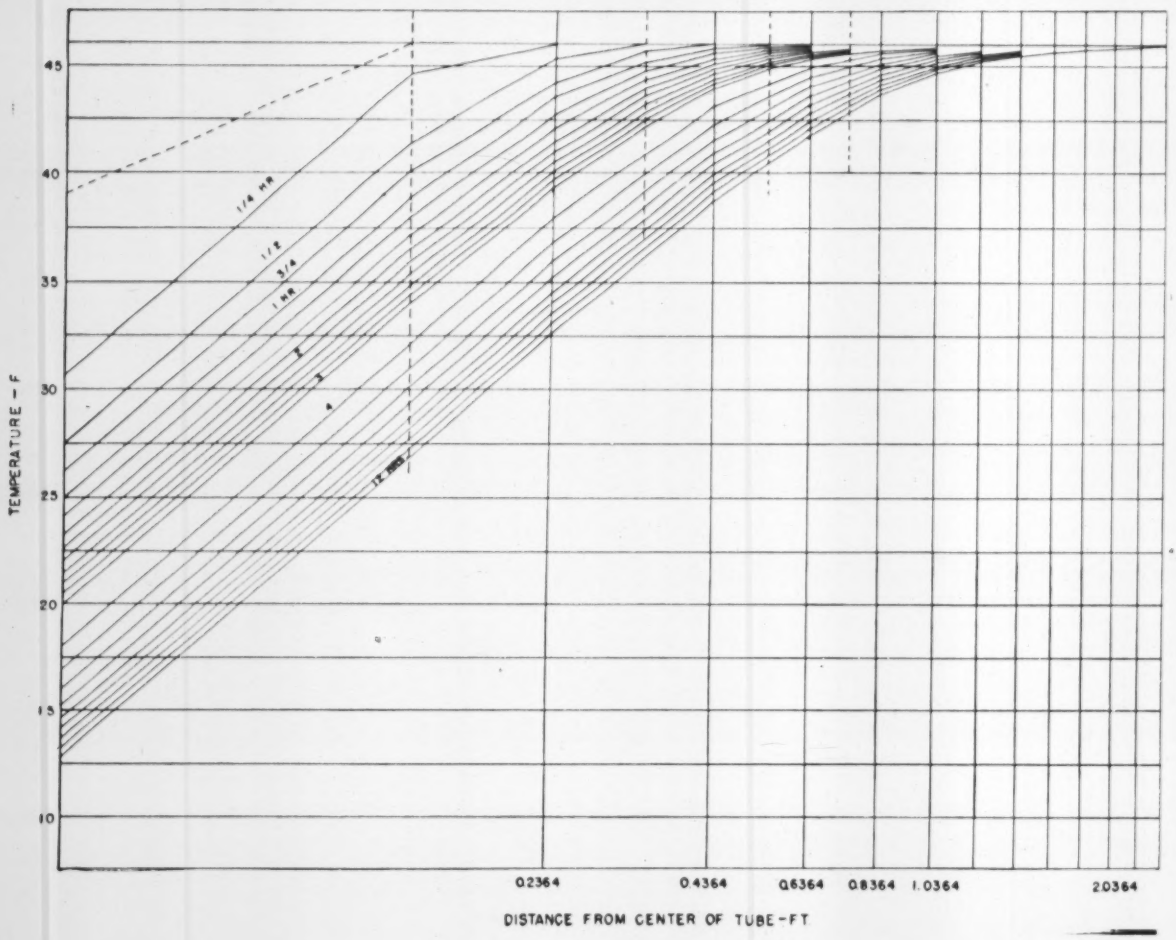
[a]Based on known operating time, pressures and manufacturer's data.
[b]Computed from heat absorbed from earth plus electrical input to compressor and fan motor.
[c]Assuming that the pump runs 50 percent in excess of compressor.

[1]Exponent numerals refer to References.

of the coil for the Binder-Schmidt representation, Fig. 12, emphasizes the importance of knowing the correct thermal conductivity of the soil. A significant decrease of this property under that used for design would prove very detrimental. Results of the present test indicated that the actual value of the thermal conductivity k was higher than that assumed, but quantitative evaluation was impossible in the absence of measured temperature distributions around the coil. Because of the extreme importance of knowing the correct value of k, a soil analysis is invaluable. This factor is discussed in Reference 3.

It is well to mention that ice formation next to the embedded tube will aid in increasing the apparent thermal conductivity in this region where an increased conductance is most needed. The latent heat supplied from freezing will produce a favorable effect, but is of very limited duration. This is seen by observation from the Binder-Schmidt analysis, Fig. 12, in that the freezing temperature advances only 0.2 ft around the tube in the 12-hour period investigated. As chilled water was used throughout the complete test reported, no advantage was realized from freezing the earth. However, heat absorption by the chilled water from the two sides and bottom of the storage tank exposed to the earth and from rather long connecting headers did aid the 480 ft of coil in supplying the load. Design of the earth heat exchanger is probably the most important factor affecting the overall performance of a heat pump. Insufficient area necessitates the use of a large displacement compressor and results in low efficiency because of the low temperature at which the refrigerant must be evaporated in absorbing the necessary heat energy. Oversizing, on the other hand, may be just as detrimental in that excessive coil surface can easily make the cost of installation prohibitive. The results from the heating season reported indicate that, by use of a storage tank, the efficiency of an indirect expansion system is comparable to that of a direct expansion. This would not be the case in the absence of the storage tank. The thermal capacity of the storage tank and the intermittent

Fig. 12—Temperature distribution around the earth coil by the Binder-Schmidt method



operation of the compressor, made operation possible at a higher temperature in the earth heat exchanger than had been anticipated.

Test results indicate that the refrigerant circuit shown in Fig. 9 is satisfactory. Pressure drops were low, and conversion from one cycle to the other was performed without difficulty. The conversion could be more readily achieved, however, by substitution of check valves for some of the globe valves shown. The experimental results reveal that the refrigeration equipment performed as predicted, and that all components of the system were well balanced. The capacity of the plant was adequate at all times, and the maximum running time during any day was 12 hr and occurred on February 2 when the outside air temperature dropped to a record of −22 F.

The cost of electrical energy for the heat pump performing with an average heating energy ratio of 3.05 is competitive with conventional systems in areas having low or medium electrical rates. The following table lists the approximate cost of electricity for which the energy expense of a heat pump is equivalent to that of heating systems utilizing conventional fuels:

Gas[a] at	Coal[b] at	Oil[c] at	Electric Resistance at
\$0.06 per 100 Ft³	\$12.50 per ton	\$0.15 per gal	\$0.015 per kwhr
\$0.009 per kwhr	\$0.010 per kwhr	\$0.017 per kwhr	\$0.046 per kwhr

[a]Heating value, 1000 Btu per cu ft, efficiency 70 percent.
[b]Heating value, 12,500 Btu per lb, efficiency 50 percent.
[c]Heating value, 135,000 Btu per gal, efficiency 68 percent.

The maintenance cost of the heat pump in this installation has averaged approximately \$8.00 annually for the past three years. The greatest portion of this resulted from a loss of charge through a faulty compressor seal and is not expected to be recurring. The maintenance cost of a heat pump is expected to be comparable to that of an equal capacity refrigeration system operating a comparable number of hours. A local refrigeration service company was able to make all necessary adjustments and repairs. Consequently, the heat pump owner was not confronted with the increased expense of a specialized heat pump repairman. With proper mechanical maintenance, aging of equipment is not expected to alter the efficiency of a heat pump; therefore the average heating energy ratio reported during the test period is expected to prevail throughout the life of the plant. If copper had not been used for the heat exchangers, increased fluid flow resistance could have resulted from corrosion, thereby decreasing the plant efficiency.

The operating efficiency is dependent on the design of the refrigeration plant with excess pressure drop in any part of the system proving detrimental. The discharge pressure is controlled by the selection of the air conditioning coil and the quantity of circulated air, while the suction temperature is a function of the balance between the compressor and evaporator. The following tabulation serves to show the influence of evaporating temperature on the plant efficiency:

Evaporator temperature F	Ratio of power supplied to heat delivered[a]
28	0.250
24	0.266
20	0.274
15	0.290
10	0.306

[a]Does not include the Joule equivalent of the heat generated by the motor.

The ratio of power required to the heat delivered at a suction temperature of 10 F increases approximately from 0.307 at 120 psig to 0.342 at 150 psig.

Design of Earth Heat Exchanger

As previously stated, the design of the earth heat exchanger represented the greatest single design problem. Excessive coil surface was to be avoided because of the high cost of copper tubing and the increased excavation expense. The first factor investigated was the depth of burial because increased depth assures the availability of a higher soil temperature but is counteracted by a greater excavation cost. This is true to a limiting depth, beyond which the summer recovery is less than the winter loss, thereby producing continuous cooling.[4] A depth of 6 ft seemed to be the optimum and also about the average reported in the literature. The yearly undisturbed temperature variation at this depth was calculated and found to be sufficiently high for a practical design. This computation was based on the assumption that the earth's surface temperature varied as a sine function passing through the maximum and minimum on July 15 and January 15, respectively. These values for the locality investigated were assumed to be 76 and 34 F, respectively, resulting in a mean surface temperature of 55 F. The temperature distribution at the depth in question was solved by the following equation from Jakob and Hawkins.[5]

$$\theta_{x\tau} = \theta_s e^{-x\sqrt{\frac{\pi n}{\alpha}}} \sin\left(2\pi n\tau - x\sqrt{\frac{\pi n}{\alpha}}\right) \quad \text{.....(1)}$$

$\theta_{x,\tau}$ = the temperature excess (relative to the mean) at any time and depth, Fahrenheit degrees.
θ_s = temperature excess (relative to the mean) at the soil surface, 21 F deg for the particular problem, Fahrenheit degrees.
e = Naperian logarithm base, 2.718.
x = depth below the surface, feet.
n = frequency of the cycle, 1 per year or 1/(365 x 24) per hour.
α = thermal diffusivity, square feet per hour.
τ = time measured from the point where the surface temperature reaches the mean while increasing and occurring on April 15 for this particular problem, hours.

The thermal conductivity and diffusivity of the soil were assumed to be 1.0 Btu per (hr) (sq ft) (F deg per ft) and 0.02 sq ft per hr, respectively. These values are possibly conservative since the soil is clay and is moistened by a normal annual precipitation of approximately 50 in.[4] The value of the diffusivity was later confirmed by Penrod and associates.[3] Table 3 presents the calculated monthly temperatures at the surface

and at the 6 ft depth below the earth's surface.

The minimum undisturbed soil temperature is observed to be 45.9 F occurring on March 15. A minimum value of 45.6 F occurs between March 1 and 15, but this is not of sufficient importance to introduce fractional time intervals. However, as extreme weather is not likely after mid-February, 46 F may be considered as the minimum undisturbed soil temperature. This is a reasonably high value and consequently a burial depth greater than 6 ft is believed uneconomical.

Heat may be extracted from the soil by lowering the coil surface below 46 F with the magnitude being proportional to the temperature differential maintained. The minimum temperature of the coil is limited by the capacity of the compressor, and if the coil area is selected on the basis of a low surface temperature, a large displacement compressor is required. In general, the balance between the two is an economic problem and the best approach to the solution is the investigation of several possible combinations. The final combination chosen for the Hopkinsville installation will be discussed as though it were a tentative one until the analysis is completed. By utilizing 480 linear ft of 7/8-in. O.D., type K copper tubing, the heat absorption rate per linear foot of tubing is readily calculated by dividing the total hourly heat absorption by the total coil length. This requires determination of the critical hourly heating demand. Three possible critical conditions must be investigated: (1) the design heat load which has a probable duration of only a few hours, (2) a rather heavy load over a prolonged cold period, and (3) the accumulated seasonal load. Each of these factors warrants an individual treatment.

The design heat load is defined as the continuous steady state rate of energy supplied to the building just adequate to replace the maximum anticipated rate of loss. It is general practice to express the design load on an hourly basis representing a daily average. The frequency of occurrence of the design load is usually from one to three times during a heating season, and the chance of two or more consecutive occurrences is indeed slight. Consequently, very rarely would the earth heat exchanger be required to supply the maximum load for a continuous period of more than one day.

Table 3—Calculated Earth Temperatures

Month	Temperature at ground surface F	Undisturbed temperature 6 ft below surface F
April 15	55.0	48.2
May 15	65.5	52.4
June 15	73.2	56.4
July 15	76.0	61.5
August 15	73.2	64.0
Sept. 15	65.5	64.1
Oct. 15	55.0	61.8
Nov. 15	44.5	57.6
Dec. 15	36.8	53.6
Jan. 15	34.0	48.5
Feb. 15	36.8	46.0
March 15	44.5	45.9

The second critical condition occurs during a prolonged cold siege during which the average hourly load is considerably less than the design maximum but also much greater than the expected normal for the period. The duration of the moderately heavy load is not likely to exceed one month, but might exist at the time when the undisturbed earth temperature is a minimum.

The final critical load will produce the most serious effect at the time when the undisturbed soil temperature sags to its low point with extended time intervals being eliminated because of a decreasing demand for heat. The average load from the beginning of the season up to the time of the minimum undisturbed soil temperature is the significant load in producing the accumulated effect.

Three methods were used to analyze the critical loading conditions: (1) Ingersoll-Plass, (2) Binder-Schmidt, and (3) relaxation. It will be observed from the following discussion that one of the methods is more readily applicable to a particular analysis than another. The first critical loading condition was analyzed by all three methods with comparable results, while the others were investigated by the Ingersoll-Plass method only.

According to Ingersoll and Plass,[4,6] for a homogeneous soil at an initially uniform temperature t_o, the surface temperature t_s of an embedded tube of radius r ft is related to the rate of heat abstraction q Btu per (hr) (ft of length), the time lapse τ (hrs), and the physical properties of the soil by the equation,

$$t_s = t_o - \frac{q}{2\pi k} I(X) \qquad (2)$$

$$X = \frac{r}{2\sqrt{\alpha \tau}}$$

$I(X)$ = Functional value of X. Evaluated in Reference 4.
k = thermal conductivity of soil, Btu per (square foot) (hour) (Fahrenheit degree per foot).
α = thermal diffusivity of soil, (square feet per hour).

The value of q for the first critical load is obtained from the calculated design heat loss of the building and the anticipated heating energy ratio of the system. Not all the energy needed to warm the building must be removed from the earth. The portion demanded of the earth q_e is obtained by multiplying the design heat load $q_o + W$ by $(R_{HE}\text{-}1)/R_{HE}$. (See Appendix A).

$$q_e = (q_o + W)\left(\frac{R_{HE} - 1}{R_{HE}}\right) \qquad (3)$$

Based on an anticipated heating energy ratio of 3.00, and a calculated heat loss of 48,000 Btu per hr (70 F inside and −5 F outside), the maximum heat sink for the 480 ft length of 7/8-in. O.D. coil becomes 66.7 Btu per (hr) (ft). Since this heavy load might occur when the undisturbed soil temperature is at its lowest, the value of t_o is taken as 46 F. Substituting these values, together with assumed ones for the physical properties of the soil into Equation 2, the surface temperature is found to be approximately 14 F, after a time lapse of 12 hr.

Fig. 12 shows the Binder-Schmidt[5,7,8] analysis for the same conditions with a resulting temperature at the tube surface of 12.7 F. This analysis is a continuous illustration of the temperature distribution throughout the soil in the proximity of the coil as time progresses.

A very important observation is that the rate of surface temperature change is very rapid near the initial time but has decreased to a very low value after 12 hr. For this reason an extension of the investigation over a longer period was deemed unnecessary. The temperature gradient in the soil adjacent to the coil allows passage of the requisite heat, 66.7 Btu per (hr) (ft), and serves as a boundary condition defining the solution.

Fig. 13 illustrates a summary of the temperature distribution surrounding the coil by use of the relaxation method.[5,7] Just as for the case of the Binder-Schmidt analysis, the boundary at the coil surface is established by the temperature gradient required to drive heat into the coil at the necessary rate. Both methods would be applicable if the boundary were established by a known surface temperature, but if this were the restriction the rate of heat flow would not likely be constant. The relaxation method gives a surface temperature of 9 F after a time lapse of 12 hrs, a value somewhat lower than that given by the other methods, but comparable.

The second critical loading condition is best investigated by Equation 2. Application of either the Binder-Schmidt or the relaxation methods to this longer time period would require more work than computation by Equation 2. It is well to emphasize that only one point is located by each application of Equation 2 while analysis by the graphical methods simultaneously gives values for all points within the region under consideration. Therefore, if the temperature distribution were desired instead of only the surface temperature, the choice would probably not be Equation 2. The average heat load over the prolonged period was assumed as one half the design load, or 33.3 Btu per (hr) (ft) for this particular design. This load corresponds to 1125 degree-days per month, and it is doubtful that this value will be exceeded for the locality in question. Solving for t_s from Equation 2, the coil surface temperature is found to be 19.1 F after a period of one month, a value considerably higher than that for the 12 hr period at maximum load.

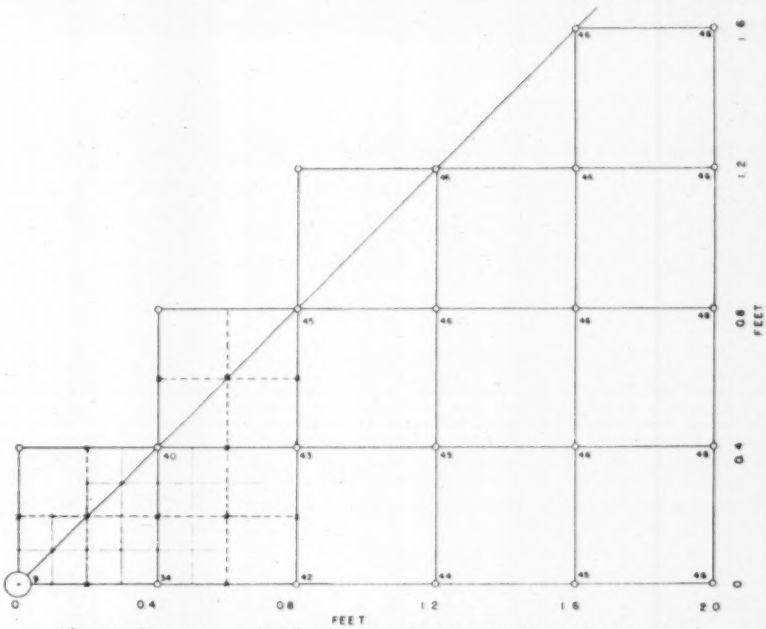


Fig. 13—Temperature distribution around earth coil after 12 hr operation by the relaxation method

The third critical loading is investigated by Equation 2 with q being determined from the average hourly heat demand from the beginning of the season to the time that the undisturbed earth temperature reaches a minimum. The value was approximated as 18.4 Btu per (hr) (ft) by use of normal degree days. The corresponding coil surface temperature was calculated as 28.7 F, revealing that the short duration heavy load is the most severe. The possibility of superimposition of condition one and three must next be considered. If this superimposition should occur, the surface temperature might be expected to fall to approximately −3 F, a value too low for practical design. This possibility was discounted on the basis of soil recovery data of Penrod and associates, (unpublished at the time of design, but included in References 1, 2 and 3). Later performance data justify the assumption, as shown by Table 1. By utilizing 960 ft of coil, the surface temperature after 12 hr operation at the design load (one half the original absorption rate per linear foot) would have dropped to 30 F rather than 14 F. The coil length of 480 ft was considered adequate.

Conclusions

This residential earth heat pump installation operated successfully during the 1950-51 heating season with the outside air temperature falling as low as −22 F.

The operating cost of an earth heat pump with a heating energy ratio of 3.05 is competitive with conventional systems in areas having low or medium electrical rates.

The Binder-Schmidt, Ingersoll and Plass, and relaxation methods may successfully be employed to design an earth heat exchanger for a heat pump system.

Acknowledgments

The author wishes to thank Dean D. V. Terrell, College of Engineering, University of Kentucky and Al Wettstein, superintendent, Hopkinsville Electric Plant Board, for making available instruments for the tests. The interest and suggestions of Prof. E. B. Penrod, Head, Department of Mechanical Engineering, University of Kentucky, were greatly

appreciated. The aid of the R. A. Wilson Co., Russellville, Ky., was invaluable in obtaining the refrigeration equipment. Appreciations are extended to Jesse F. Baker, owner, for patiently and interestingly recording data.

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APPENDIX A

Development of Equation 3

By definition the heating energy ratio is

$$R_{HE} = (q_e + W)/W \quad \ldots\ldots\ldots (A\text{-}1)$$

where

q_e = heat energy taken from the earth.

W = electrical energy supplied to the motors.

By rearranging Equation A-1,

$$W(R_{HE}) = (q_e + W) \quad \ldots\ldots\ldots (A\text{-}2)$$

or

$$q_e = W(R_{HE} - 1)$$

or

$$q_e/(W+q_e) = W(R_{HE}-1)/(W+q_e) \quad \ldots\ldots\ldots (A\text{-}3)$$

Substituting $1/R_{HE}$ for $W/(W+q_e)$,

$$q_e = (q_e+W)\,[(R_{HE}-1)/R_{HE}] \quad \ldots\ldots\ldots (A\text{-}4)$$

Equation A-4 is Equation 3 of the paper.

APPENDIX B

Calculations

Undisturbed Soil Temperatures

Given the following conditions:

$\Theta_e = 21$ F

$x = 6$ ft

$a = 0.02$ sq ft per hr

1 cycle per year = 1/8760 cycles per hr = 1/12 cycle per month.

Find undisturbed soil temperature t_{ux} on May 15.

$$\sqrt{\frac{\pi n}{\alpha}} = \sqrt{\frac{\pi \frac{1}{8760}}{0.02}} = 0.134 \text{ ft}$$

$$\Theta_0 e^{-x\sqrt{\frac{\pi n}{\alpha}}} = 9.4$$

Values of τ for various months are as follows: May 15 = 1, June 15 = 2, July 15 = 3, and April 15 = 12.

Substituting in Equation 1 of the paper:

$\Theta_x\tau = 9.4 \sin[(\pi/6) = 0.804] = -2.6$ F deg.

$t_x\tau = 55.0 - 2.6 = 52.4$ F

Coil Surface Temperatures by the Ingersoll and Plass Method

For Critical Loading Condition 1

The various terms are as follows:

$\tau = 12$ hr

$r = 7/8/2{:}12$

$q = 66.7$ Btu per (hr) (ft)

$k = 1$ Btu per (hr) (sq ft) (F deg per ft)

$a = 0.02$ sq ft per hr

Then

$$X = \frac{0.0364}{2\sqrt{0.02 \times 12}} = 0.0372$$

$I(X) = 3.012$ (Page 340, Reference 4)

Substituting the proper values in Equation 2 of the paper:

$$t_s = 46.0 - \frac{66.7}{2\pi(1)}(3.012) = 46.0 - 32.0 = 14.0\,F$$

For Critical Loading Condition 2

The various terms are as follows:

$\tau = 720$ hr

$q = 33.3$ Btu per (hr) (ft)

Then

$$X = \frac{0.0364}{2\sqrt{0.02 \times 720}} = 0.0048$$

$I(X) = 5.06$ (Page 340, Reference 4)

The coil surface temperature, by substituting proper values in Equation 2, is,

$$t_s = 46.0 - \frac{33.3}{6.28(1)}(5.06) = 46.0 - 26.9 = 19.1\,F$$

For Critical Loading Condition 3

$\tau = 3410$ hr

$q = 18.4$ Btu per (hr) (ft) (Average between Sept. 21 and Feb. 15)

Then by substituting proper values in Equation 2, the coil surface temperature is,

$$t_s = 46.0 - \frac{18.4}{2\pi(1)}(5.84) = 28.8\,F.$$

Discussion

J. DONALD KROEKER, Portland, Ore., stated that the combination of a storage tank and ground coil in this installation provided the advantage of accessibility of refrigerant piping, which permitted observation of ice formation. The use of water in the ground coil lessened the importance of leakage from the coil.

Apparently the installation had more ground coil than necessary, although a total of 480 ft of piping as used in this installation would be considered less than that found necessary for a similar-sized installation in the Pacific Northwest.

Mr. Kroeker felt that the heat energy ratio reported in the paper was higher than the average seasonal ratio which he had found by experience. He suggested that it would be advantageous to have information on the actual ground temperatures occurring in the installation.

G. O. G. LOF, Denver, Colo., asked for further information on the type of soil in which the coil was buried. He also inquired whether the circulating pump was controlled independently of the compressor, and if so, what the primary control element was for the circulating pump.

G. W. HUMMEL, Phoenix, Ariz., asked whether the electric rate at the installation is considered a favorable one. He also asked about the overall cost of operation per day.

S. S. SANFORD, Detroit, Mich., asked for information on the horsepower and energy consumption of the water circulating pump. It was not clear in the paper whether this energy consumption was included in the total energy required. Mr. Sanford inquired whether the electric consumption for the electric circulating pump was taken into consideration when the author made the statement in the paper that *by use of a storage tank the efficiency of an indirect expansion system is comparable to that of a direct expansion system.* He also inquiried whether the statement related only to the temperature level at which this system operates.

Since the author found that the capacity of the installation was adequate even

when the temperature dropped to −22 F, at which time the system operated only for 12 hr, it seemed possible that a smaller ground coil would have given adequate capacity with a consequent lower heat energy ratio and a lower seasonal performance factor. A record of the performance for the two years following the test would be of interest if these values are available.

Mr. Sanford inquired why the tank was made so large that the use of an antifreeze solution was found unnecessary.

M. K. Fahnestock, Urbana, Ill., suggested that since 'year-round comfort air conditioning is becoming more popular for residential work, it would be important to include information on both the cooling and heating cycle. This would be particularly true for heat pump installations.

Professor Fahnestock suggested that the test should be extended for the purpose of obtaining more information on the actual conditions in the residence during both heating and cooling cycles.

One difficulty in the application of the heat pump to residential work is caused by the difference in air volumes that have to be handled for cooling as compared to the volume required for heating.

W. F. Friend, New York, N.Y., asked for an explanation of the small size (¼ hp) motor required by the air circulating fan, which was circulating air at temperatures of about 105 F.

A direct measurement of the heat transfer from the ground to the coil could have been obtained directly by metering the water circulated through the coil and taking the temperature of the water entering and leaving the coil. Apparently the author determined the heat quantities from the manufacturer's characteristic performance curves for the heat pump. Mr. Friend also inquired what effect the author would anticipate if the ground coil had been increased 50 percent or if it had been decreased 50 percent.

Y. S. Touloukian,* West Lafayette, Ind., stated that Dr. Baker would give careful consideration to the comments and prepare an author's closure which would be published later.

Dr. Touloukian stated that his impression of work being done on the heat pump was that university research was being conducted mostly with ground coils, whereas industry seemed to be working mostly with air to air systems. He felt that air to air applications had geographical limitations, whereas ground coils at a depth of about 8 ft could be used in a wider area. With ground coils, areas having high precipitation would be more favored. While ground coils would be subject to less temperature fluctuation than air coils, their performance would be more difficult to predict because of the many physical factors involved in the condition of the soil.

*Dr. Touloukian presented the paper in absence of author.

FUNDAMENTAL RESEARCH WILL FIND THE ANSWER

In a New York Times editorial entitled "Discoveries Yet To Come" a strong case is made for expansion of fundamental research projects.

"At a gathering of seventy-five outstanding scientists, engineers and business men Ralph J. Cordiner, president of the General Electric Co., pleaded for more fundamental research by industrial laboratories and supported his argument with the announcement that his own company planned to increase its research staff from 1,000 to 1,500. Industry used to wait for the universities to make the discoveries on which the telephone, the automobile and many a chemical process were based, but in recent years it has been doing its own discovering. The more it discovers the more brilliant is the technological future.

"Fundamental research alone can solve problems that have long baffled science and engineering, bringing with the solution more comforts, more mechanization, more electrification. Heat engines are operating at ever higher temperatures. But where are the metals that will stand up under the intense heat that the engineer wants? Fundamental research will find them, and when they are found we shall have jet engines and gas-turbines of unprecedented power. The problem of more efficient lighting is still in an unsatisfactory state. Why can't we develop phosphorescent materials which will convert warmth into visible light? Because not enough is known about infrared radiation. To generate electric energy we have to raise steam with which to drive a turbo-generator or use an internal combustion engine. Why can't the heat of burning fuel be converted directly into electricity? Mr. Cordiner is all for conducting fundamental research that will point the way to a *fuel call*.

"There are scores of these problems. In the past we waited Micawber-like for something to turn up that would simplify the process of solving them. But systematic research, as it is conducted in the laboratories of the great corporations, telescopes time. Not only are fundamental discoveries made, but they are developed — brought to the stage where the practical engineer can apply them. A discovery may pass through half a dozen laboratories before the world sees the engines, the process, the product that flowered from it.

"There is romance in all this and high adventure. Suppose that Hans Christian Andersen had finished one of his fairy tales with the sentence *And the princess rode off on four bubbles of air*. Millions of princesses are doing just that — only the bubbles of air are inflated rubber tires. It is wonderful to see a familiar face on a television screen or to participate in Queen Elizabeth's coronation in a motion-picture theater. But there is more to come — much more as Mr. Cordiner sees it. A discovery is not a terminal, but a door that the fundamental scientist opens to disclose a new prospect."

G. K. IWASHITA PROMOTED

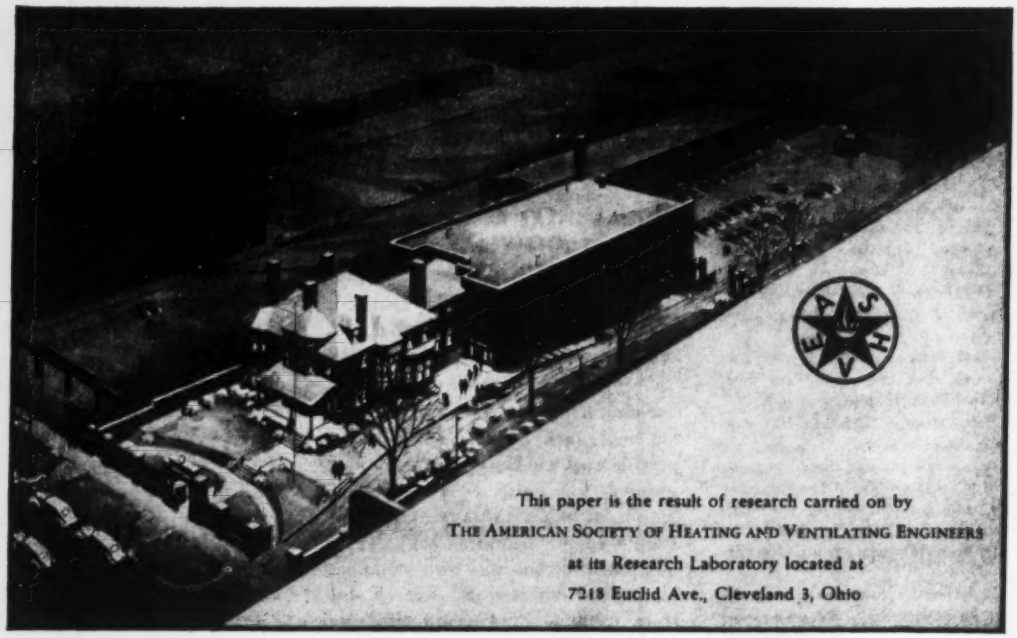
George K. Iwashita, general manager of the Commercial Products Department, Air Conditioning Division, General Electric Co., Bloomfield, N. J., received a promotion to Lieutenant Colonel in the 78th Infantry Division, Division G-2 Intelligence, on July 16 at Camp Drum where the New Jersey reserve unit was undergoing its annual field training.

During World War II he served as a Captain in the 442nd regimental combat team in Europe and later in the Pacific as a Major in the intelligence section of General MacArthur's headquarters.

Besides his ASHVE membership he is also national membership chairman and a director of the *ASRE*, a member of the *ASTM*, the *AIEE*, and many other engineering groups.

HOUSTON

January 25-27, 1954


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Design Data for Slat-Type Sun Shades for Use in Load Estimating

By G. V. Parmelee* and D. J. Vild**, Cleveland, Ohio

A STUDY OF the effectiveness of slat-type sun shades has been carried on at the ASHVE Research Laboratory, Cleveland, as part of the Society's research program. It has had the advisory guidance of the Technical Advisory Committee on Heat Flow Through Glass.† This paper gives design data for Venetian blinds and sun screens in combination with several types of single flat glass based upon experimental data[1,2] and a previously presented theoretical treatment.[3] The data in this paper are limited to sun shades which are in a vertical plane, and which have opaque slats running in a horizontal direction set at such angles as to tend to exclude radiation from above-the-horizon sources.

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[1]Exponent numerals refer to References.

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SUMMARY—This paper reduces previous experimental results and data to a form suitable for practical application in determining instantaneous heat gain from several types of flat glass in combination with Venetian blinds and sun screens.

Physical characteristics of slat-type shades are summarized and their effects on reduction of heat gain are evaluated. Comparisons of the experimental results with heat gain values in current use indicate that reduction of heat gain with some shade and glass combinations is greater than anticipated in present design values.

Examples are given to illustrate the design application of the data shown in the tables and charts.

Characteristics of Slat-Type Sunshades

The effectiveness of a sun shade can be examined from two viewpoints: (1) the part of the sun's radiant energy that the shade excludes, and (2) the part of the sun's energy that it admits to the room. Because in most applications engineers need to estimate the magnitude of sun heat gains, the problem will be discussed with the second viewpoint in mind.

Heat gain from a sun shade-window combination consists of two components:

1. Heat gain due to transmitted direct and diffuse solar radiation, and
2. Heat gain due to convection and radiation.

The first component refers to the solar energy which passes through the sun shade; the second component refers to the gain which results from solar radiation being absorbed by the glass-shade combination. These heat gains are dependent upon the variables in the following list (also see Figs. 1 and 2):

1. *Position of the sun*: (a) Profile or shadow-line angle, ϕ; (b) Altitude of the sun, β; (c) Incident angle, θ.

2. *Sun shade characteristics*: (a) Color (or solar absorptance, α) of the slats; (b) Slat angle, ψ; (c) Ratio of slat width to

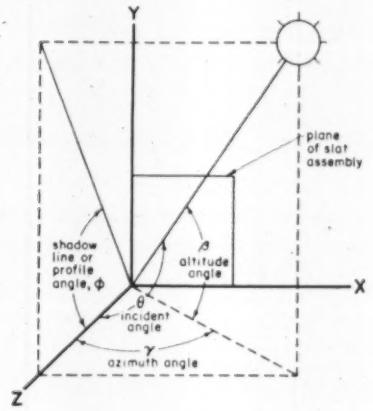

Fig. 1—Definition of angles

slat spacing, W/S, hereafter referred to as spacing ratio; (d) Ratio of slat thickness to slat spacing, D/S, hereafter referred to as thickness ratio.

3. Shade location, *i.e.*, indoors or outdoors.

4. Characteristics of the glass with which the shade is used.

5. Weather conditions and the indoor environment.

The adjustment or design of any slat-type sun shade for *best performance* requires a compromise between sun heat exclusion, lighting, and vision. If a space is not to be air conditioned, ventilation must also be considered. The possibilities of obtaining adequate natural lighting on sun exposures with a minimum of energy input to the room through the use of slat-type sun shades is an interesting problem that merits investigation. This paper and others[1,2,3] provide some useful data and analytical methods applicable to such problems.

The surfaces of most painted or chemically treated slats of shades in present use can be classed as diffuse reflectors. A general discussion of the performance characteristics of sun shades with this type of slat follows:

1. The spacing ratio of Venetian blinds being manufactured today is standardized at 1.2. The slat angle is adjustable through all angles. Normal slat curvature does not significantly change the shade performance. The thickness ratio for metal slats is so small as to be insignificant.

2. The spacing ratio of screen-type shades of current manufacture varies from 0.8 to 1.0. Slat angles are fixed and most shades have a 17 deg slat angle. Some are set at 30 deg. The thickness ratio is an important factor.

3. Transmitted solar radiation consists of *straight-through* and *reflected-through* components. Both components are influenced by profile or shadow-line angle, slat angle, and spacing ratio. The *reflected-through* component is also dependent upon the absorptance of the slat for solar radiation and does not change rapidly with profile angle.

4. An increase in slat angle increases the total energy reflected to the outside

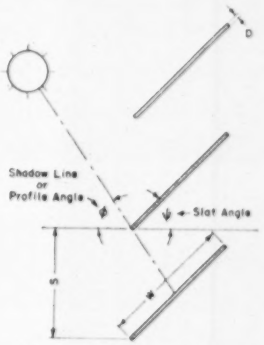

Fig. 2—Geometry of slat-type sunshades

and decreases the amount admitted to the room.

5. A spacing ratio of 1.2 with a slat angle of 45 deg will exclude the *straight-through* component on all orientations in the north latitudes between 6 a.m. and 6 p.m. from May 1 to the middle of August. A 30-deg slat angle will do the same between 7 a.m. and 5 p.m. but will approximately double the *reflected-through* component and increase the radiation absorbed by the shade.

6. The slat surface absorptance of most of the Venetian blinds manufactured today is of the order of 0.40 for total solar energy. The absorptance for light is considerably less.

7. A decrease in slat absorptance (higher slat reflectance) increases the amount of solar radiation admitted to the room by increasing the *reflected through* component, but it also increases the energy

Table 1—Shade Factors for Slat-Type Sun Shades with Diffuse Reflecting Slats

Solar Absorptance of Slat a	Color of Slat (approx.)	Slat Width Spacing Ratio, W/S	Slat Angle ψ	Shade Location	Glass Type	Shade Factors		
						Window in Shade	Window in Sun	
							Factor	Lower Limit of Profile Angle Degrees
0.2	See footnote[a]	1.2[b]	45	Indoors	Common	0.51	0.45	10
0.4	white, ivory cream	"	"	"	"	0.59	0.56	"
0.6	light colors	"	"	"	"	0.67	0.65	"
0.8	dark colors	"	"	"	"	0.75	0.75	"
1.0	black	"	"	"	"	0.81	0.82	"
0.4	white, ivory cream	1.2	0[c]	"	"	0.77	0.69	40
0.4	"	"	30	"	"	0.65	0.59	20
0.4	"	"	45	"	"	0.59	0.56	10
0.4	"	"	60	"	"	0.53	0.49	none
0.4	"	"	90[c]	"	"	0.37	0.41	none
0.4	"	"	45	"	Regular Plate[d]	0.63	0.58	10
0.4	"	"	45	"	Heat Absorbing Plate[e]	0.56	0.55	10
0.4	white, ivory cream	1.2	45	Outdoors	Common	0.30	0.15	10
0.4	green tint[f]	1.0	17	"	"	0.37	0.22	30
0.8	black[g]	0.8	17	"	"	0.32	0.15	40

[a]Approximated by diffuse reflecting aluminum with protective anodic coating.
[b]Standard spacing ratio for venetian blinds; thickness-spacing ratio negligible.
[c]Estimated, see text.
[d]Normal incidence transmittance equals 0.77.
[e]Normal incidence transmittance equals 0.41.
[f]Screen-type shade of chemically treated aluminum, thickness ratio = 0.15.
[g]Screen-type shade of chemically treated bronze; thickness ratio = 0.085.

reflected to the outside. The total heat gain is therefore reduced.

8. Roughly ½ of the *reflected-through* component enters the room in a generally upward direction, if the source of radiation is from above the horizon.

9. Slat-type shades have a high transmittance for ground reflected solar radiation, which may constitute a sizeable fraction of the incident diffuse solar radiation. The transmittance for both *above-the-horizon* and *below-the-horizon* diffuse solar radiation is generally greater than the reflected-through transmittance of direct solar radiation.

10. When a shade is installed on the outdoor side of common glass the convection and radiation gain is equal to about 5 percent of the solar radiation absorbed by the shade-glass combination plus the convection and radiation gain for single unshaded common glass under the same conditions of temperature and weather. Slat size and slat angle variations between 20 to 45 deg have only a small effect.

11. When a shade is installed on the indoor side of common glass, the percentage is about 75.

12. A shade installed indoors reduces the overall steady state conductance of a single window. For 30 deg slats with a spacing ratio of 1.2, the reduction is about 15 percent.

Although discussion has been confined to shades which have diffuse reflecting slats, those interested in the problem should not overlook the high reflectance[1] of specular reflecting (mirror like) surfaces under certain conditions. In concluding this discussion, it is well to emphasize that the principles and data given in this and earlier papers have general application not only to the common Venetian blind but also any sun screen of flat opaque slats.

Design Data

Shade Factors

The shade factor is defined as the total gain from a shade-glass combination minus the convection and radiation gain from single *unshaded common window glass* divided by the total incident solar radiation transmitted by single unshaded common window glass. In equation form,

$$\text{Shade Factor} = \frac{\text{Total Gain from Shade-Glass Combination} - \text{Convection \& Radiation Gain from Single Unshaded Common Glass}}{\text{Total Solar Energy Transmitted by Single Unshaded Common Glass}}$$

Design shade factors for a number of combinations* are listed in Table 1. The total gain for a shaded window is found by multiplying the values of Table 13, p. 289 of Chapter 13, Cooling Load, of THE GUIDE 1953 by the appropriate shade factor and adding to these values the corresponding values from Table 14, p. 289 of the same chapter of THE GUIDE. (Table 13 gives total transmitted solar radiation and Table 14 gives convection and radiation gain from single unshaded common window glass.) These tables are reproduced in the Appendix as Tables A-1 and A-2, respectively.

The values for sunlit windows are average values based upon calculations for several orientations. Actually the shade factor varies somewhat with orientation and time of day, because the proportion of direct to diffuse incident solar radiation as well as the profile angle varies. However, for the range in angles indicated for each shade, this variation is small enough to be ignored in estimating cooling load. The lower limit of the profile angle for which each value is applicable is the approximate *cut-off* angle. For angles less than this value the sun's direct rays can pass through the slats and the shade factor increases rapidly. This is offset in part by the fact that below about 15 deg a decrease in profile angle is accompanied by a decrease in sun intensity. This results

*Procedures and data by which the performance of other shade-glass combinations can be estimated are available in mimeograph form and can be obtained upon written request to the ASHVE Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

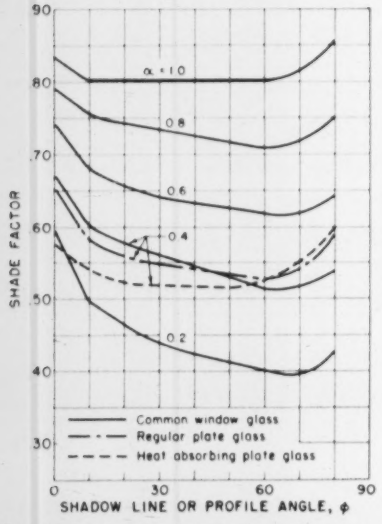

Fig. 3—Shade factors for indoor slat-type sunshades *vs.* profile angle, ϕ, and slat absorptance, α: slat angle, ψ = 45 deg; spacing ratio, W/S = 1.2

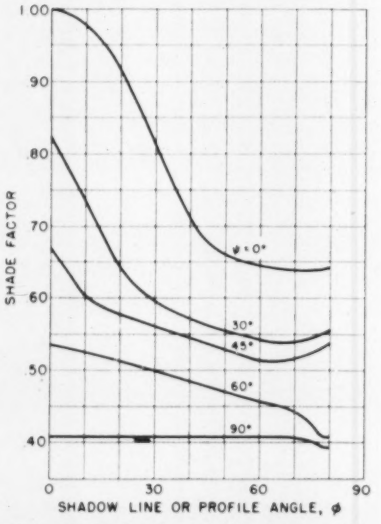

Fig. 4—Shade factors for indoor slat-type sunshades *vs.* profile angle, ϕ, and slat angle, ψ: slat absorptance, α = 0.4; spacing ratio, W/S = 1.2

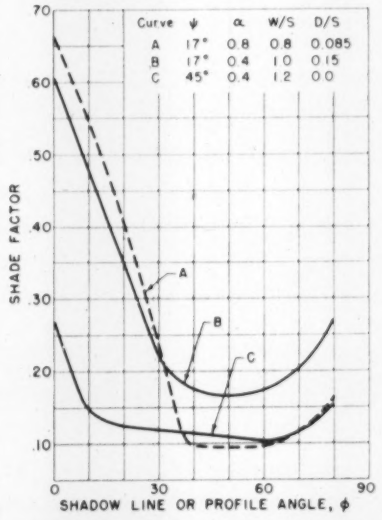

Fig. 5—Shade factors for outdoor slat-type sunshades *vs.* profile angle, ϕ

in a moderate increase in heat gain, or a decrease, depending upon orientation.

The factors of Table 1 which have a lower limit of 10 deg cover most cases. To supplement Table 1, Figs. 3, 4, and 5 give shade factors as a function of the shadow line or profile angle. The factors given by these figures apply to direct solar radiation only so that computations must treat direct and diffuse radiation separately. These figures are to be used with Table 2, which lists profile angles for three latitudes and eight orientations on August 1. The use of these factors is illustrated in a following section.

Shade Color

Shade factors have been given in terms of total solar energy absorptance of the slat surface. This value can be established by tests in sunlight or by calculation from spectral absorptance or reflectance values. While spectral data are readily obtainable for the visible portion of the sun's spectrum, data for the infrared portion of the spectrum are rarely available and hence the total absorptance usually must be estimated. From a practical application viewpoint, factors must be selected on the basis of color. Hence, colors have been included in Table 1, but this classification is approximate. About 80 percent of the Venetian blinds manufactured today have white, ivory or eggshell finish. Light absorptances[4] of a typical sample of each were 18, 30 and 34 percent respectively. However, for the total solar spectrum the absorptance values would be higher. Tests[1,5] of white painted surfaces in sunlight gave values ranging from 0.28 to 0.51. Tests with artificial light sources[6,7] gave values of from 0.18 to 0.32 for commercial white paints with values[7] for white pigments in oil as high as 0.43. The temperature rise[8] of glossy white, flat white, ivory and canary yellow paints exposed to sunlight were 31, 35, 40, and 45 percent, respectively, of the rise observed for lampblack under the same conditions. Approximate solar absorptances would be a few percentage points higher in each case. It is evident, therefore, that the selection of shade factors in terms of slat color is an approximation. It is also apparent that careful selection of paints to be used on indoor Venetian blinds can lead to significant improvements in shade performance. From the viewpoint of sun heat reduction, color does not seem to be important for outdoor shades. It may assume importance if the shade has light control functions.

Table 2—Values of the Shadow Line or Profile Angle, ϕ, for Variously Oriented Vertical Surfaces Computed for 18 Deg Declination, North (August 1)

Latitude	Sun Time		Profile Angle, ϕ, Degrees					
	A.M. → ↓		N	NE	E	SE	S	SW
	6 a.m.	6 p.m.	30	10	9	18		
	7	5	68	26	22	34		
	8	4	87	43	35	45		
30 Deg N.	9	3		60	48	54	85	
	10	2		75	61	63	80	
	11	1		88	76	72	79	
	12				90	81	78	81
	5 a.m.	7 p.m.	1	1	1	2		
	6	6	40	13	12	22		
	7	5	75	29	23	34		
40 Deg N.	8	4		47	35	42	83	
	9	3		65	47	49	75	
	10	2		81	60	57	71	
	11	1			75	65	69	86
	12				90	74	67	74
	5 a.m.	7 p.m.	11	4	4	12		
	6	6	49	16	14	24		
	7	5	90	32	24	32	90	
50 Deg N.	8	4		50	34	38	72	
	9	3		69	45	44	65	
	10	2		87	58	50	61	
	11	1			74	57	59	78
	12				90	66	58	66
		↑ P.M. →	N	NW	W	SW	S	SE

Illustrative Examples

Example 1: Find the total instantaneous rate of heat gain for common window glass provided with an indoor white Venetian blind. Slats are set at 45 deg and have a spacing ratio of 1.2. The orientation is west, the time is 4 p.m. on August 1 and the latitude is 40 deg, north. Design dry bulb temperatures are 80 F indoor and 95 F maximum outdoor.

Solution: Table 2 shows that the profile angle is 35 deg. Hence, factor 0.56 of Table 1 is applicable. Tables A-1 and A-2 of the Appendix show that the gain due to transmitted solar radiation and to convection and radiation are, respectively, 205 and 20 Btu per (hr) (sq ft) for unshaded common window glass, giving a total gain of 225 Btu per (hr) (sq ft). The total gain for the shaded window equals

$$0.56\ (205) + 20 = 134.8 \text{ Btu per (hr) (sq ft)}$$

Example 2: Same as *Example 1* except the slats are horizontal (slat angle = 0 deg).

Solution: The Table 1 factor of 0.69 cannot be used because the profile angle is less than 40 deg (Table 2). The gain must be found in three steps. The gain due to diffuse radiation on an unshaded west window at 4 p.m. is 28 Btu per (hr) (sq ft). [See THE GUIDE 1953, Chapter 13. For a solar altitude at 4 p.m. of 34.5 deg (Table 6), the incident diffuse radiation is 36 Btu per (hr) (sq ft) (Table 4) of which 0.79 (Table 12) is transmitted.] The gain due to direct radiation on the west window is therefore $205 - 28 = 177$ Btu per (hr) (sq ft). The shade factors are 0.77 for diffuse radiation (Table 1) and 0.76 for direct radiation (Fig. 4). The total instantaneous gain for the unshaded window equals

$$0.77\ (28) + 0.76\ (177) + 20 = 176.1 \text{ Btu per (hr) (sq ft)}$$

Example 3: Same as *Example 1* except that the glass is single heat absorbing plate glass.

Solution: Note that the factor of 0.55 in Table 1 is applied to the transmitted gain of *single common window glass* and that Appendix Table A-1 values are used as in the preceding examples. (The factors of Table 15 and the values of Table 16 in Chapter 13 of THE GUIDE 1953 lead to a total gain of 150.3 Btu per (hr) (sq ft) for single unshaded heat absorbing glass, but are not used in the computations for shading.) The total instantaneous gain for shaded heat absorbing glass is

$$0.55\ (205) + 20 = 132.8$$

Example 4: Same as *Example 1* except that the window has a screen-type shade with black slats on outside of window. The spacing ratio is 0.8, the slat angle is 17 deg.

Solution: This example is worked like *Example* 2. The shade factors are 0.32 (Table 1) and 0.15 (Fig. 5) for diffuse and direct radiation respectively. The total instantaneous gain is

0.32 (28) + 0.15 (177) + 20 = 55.5 Btu per (hr) (sq ft)

Design Assumptions

Experimental work showed that the increase in convection and radiation gain caused by the addition of an indoor shade to common glass was proportional to the solar radiation absorbed by the combination and was practically independent of slat width (0.049 and 2 in.), spacing ratio (0.8 and 1.2), and slat angle (20 to 45 deg) values covered by the experiments. It seemed reasonable to conclude that the same proportional value could be applied to both the horizontal and closed slat positions without serious error.

Night tests run with an indoor white shade with slats at 30 deg and spacing ratio of 1.2 showed that this arrangement reduced the overall coefficient of heat transfer U by 15 percent. However, with sun incident on the window, the effect of differences between the indoor and outdoor temperatures was not apparent in the experiments. Hence, no adjustment has been made to the values in appendix Table A-2 (convection and radiation gain from common unshaded glass). The shade factors of Table 1 and Figs. 3, 4, and 5 can therefore be used for all seasons and orientations with reasonable accuracy. It is only necessary to compute the gains due to transmitted solar radiation by unshaded common window glass and the gain (or loss) by convection and radiation and to proceed as in *Example* 2.

The effect of supporting tapes has been ignored. They would reduce the transmitted gain by 5 to 8 percent. The shade absorptance would be altered, depending upon color relative to the slat color.

Diffuse radiation comes from the sky and also from the ground by reflection of both direct and diffuse radiation. Analysis of test data showed that about 25 percent of the incident diffuse radiation came from the ground and 75 percent from the sky. These proportions were used in computing design values of absorptance and transmittance of diffuse solar radiation.

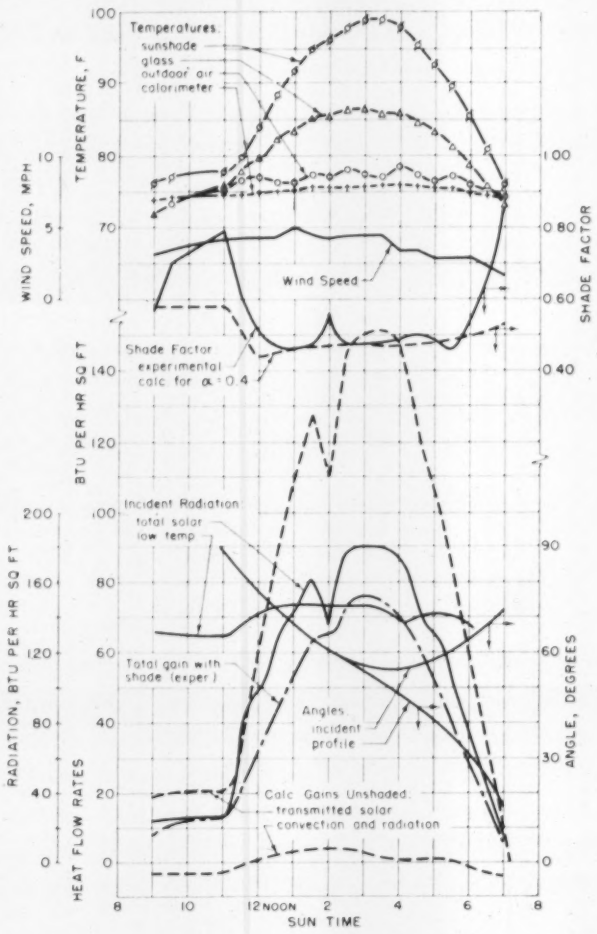

Fig. 6—Test results and shade factors for white slat shade inside glass No. 2: southwest orientation, July 2, 1951, slat angle — 45 deg, slat spacing ratio — 1.2

Allowance should be made if necessary for partial shading by window reveals and sash members.

Discussion

Comparison of the shade factors of Table 1 with values given in Table 24 of Chapter 13 of THE GUIDE 1953 can be made if light, medium and dark colors be accepted as equivalent to slat absorptances of 0.4, 0.6 and 0.8 respectively. For a 45-deg slat setting and a spacing ratio of 1.2 the Table 1 values are 0.56, 0.65 and 0.75 compared with the values of 0.62, 0.74, and 0.86 for the three colors respectively in THE GUIDE. The new data give about a 10 percent greater reduction in sun load than the presently used data. The new factor for white slats outside, 0.15, is just one-half the value of 0.30 in THE GUIDE. The new values for the black screen-type shade are also lower. The value of 0.70 given for aluminum slats, in THE GUIDE, also needs revision. The specific reflecting character of the aluminum is not known, but both specular and diffuse reflecting aluminum should give much lower values, although the factor for specular slats could be this high for low profile angles.

Table 1 and Fig. 4 show that the effectiveness of a slat-type shade increases as the slat angle increases.

A minimum factor of 0.41 is attained by the shade with slat absorptance of 0.4 when the slats are fully closed. This value is, as indicated previously, an estimate. The values for a closed blind, a fully drawn roller shade, and a drawn drape, should be about the same if each has the same absorptance for solar radiation. The value of 0.45 used in THE GUIDE for a fully drawn white roller shade (it is believed that this is an estimate based upon calculations) compares favorably.

Table 1 shows that outdoor shades are very effective and that it makes little difference whether the exclusion of sun heat is by reflection or by absorption with heat loss to the outdoor environment by convection and reradiation. Note, however, from Fig. 5 that the screen-type shade with fixed slats decreases rapidly in effectiveness as the profile angle decreases, starting at about 35 to 40 deg. Below about 15 deg, this is compensated in part by the fact that sun intensity decreases, so that heat gains increase less rapidly than the effectiveness decreases, or they may decrease, depending upon orientation.

It will be seen that total heat gain with a heat absorbing glass with an indoor white shade is practically the same as for common window glass and a white shade. Compared with unshaded heat absorbing glass, the total gain is reduced about 10 percent by the use of a shade. These findings are similar to those observed by Leopold[9] in scale model tests with an artificial sun. Table 1 gives factors of 0.56, 0.58, and 0.55 for different types of flat glass with an indoor shade having a slat absorptance of 0.4, a slat angle of 45 deg and a spacing ratio of 1.2. The small difference in these values indicates that the factor for any given shade and common window glass is a reasonably satisfactory value for this shade with any type of single flat glass.

Data on glass and shade temperatures to be expected under various conditions and a detailed analysis of the heat gain components are given in Reference 2. Typical values of temperature are illustrated by Fig. 6 which gives test data for a white shade on the inside of a high transmission glass (sample No. 2, see Reference 10). The slat angle was 45 deg and the spacing ratio was 1.2. The observed solar intensity values are slightly below design values and the outdoor dry-bulb temperatures are much below, a combi-

APPENDIX

Tables A-1 and A-2 are taken from Chapter 13, Cooling Load, of the Heating Ventilating Air Conditioning Guide 1953.

Table A-1*—Instantaneous Rates of Heat Gain Due to Transmitted Direct and Diffuse or Sky Solar Radiation by a Single Sheet of Unshaded Common Window Glass

For Clear Atmospheres and 18 Deg Declination, North (August 1)

Note: For total instantaneous heat gain, add these values to the Table 14 values.

Latitude	Sun Time AM →	Sun Time ← PM	Instantaneous Heat Gain in Btu per (hr) (sq ft) N	NE	E	SE	S	SW	W	NW	Horiz.
	6 a.m.	6 p.m.	25	98	108	52	5	5	5	5	17
	7	5	23	155	190	110	10	10	10	10	71
	8	4	16	148	205	136	14	13	13	13	137
30 Deg N.	9	3	16	106	180	136	21	15	15	15	195
	10	2	17	54	128	116	34	17	16	16	241
	11	1	18	20	59	78	45	19	18	18	267
	12		18	19	19	35	49	35	19	19	276
	5 a.m.	7 p.m.	3	7	6	2	0	0	0	0	1
	6	6	26	116	131	67	7	6	6	6	25
	7	5	16	149	195	124	11	10	10	10	77
40 Deg N.	8	4	14	129	205	156	18	12	12	12	137
	9	3	15	79	180	162	42	14	14	14	188
	10	2	16	31	127	148	69	16	16	16	229
	11	1	17	18	58	113	90	23	17	17	252
	12		17	17	19	64	98	64	19	17	259
	5 a.m.	7 p.m.	20	54	54	20	3	3	3	3	6
	6	6	25	128	149	81	8	7	7	7	34
	7	5	12	139	197	136	12	10	10	10	80
50 Deg N.	8	4	13	107	202	171	32	12	12	12	129
	9	3	14	54	176	183	72	14	14	14	173
	10	2	15	18	124	174	110	16	15	15	206
	11	1	16	16	57	143	136	42	16	16	227
	12		16	16	18	96	144	96	18	16	234
		PM →	N	NW	W	SW	S	SE	E	NE	Horiz.

*See Table 13, Chapter 13, THE GUIDE 1953.

Table A-2*—Instantaneous Rates of Heat Gain by Convection and Radiation from a Single Sheet of Unshaded Common Window Glass

For Clear Atmospheres and 18 Deg Declination, North (August 1)

For 80 F Indoor Temperature

Note: For total instantaneous heat gain, add these values to the Table 13 values.

Sun Time	Dry-Bulb Deg F	North Latitude Degrees	Instantaneous Heat Gain in Btu per (hr) (sq ft) N	NE	E	SE	S	SW	W	NW	Horiz.
5 a.m.	74		—6	—6	—6	—6	—6	—6	—6	—6	—6
6	74		—5	—4	—4	—5	—5	—6	—6	—6	—5
7	75		—5	—2	—2	—3	—5	—5	—5	—5	—3
8	77		—3	0	1	0	—2	—3	—3	—3	0
9	80		0	2	4	3	1	0	0	0	3
10	83		3	4	6	6	5	3	3	3	8
11	87		8	8	10	11	10	9	8	8	13
12	90	30, 40, 50	12	12	12	13	14	13	12	12	16
1 p.m.	93		15	15	15	16	17	17	17	15	20
2	94		16	16	16	16	18	19	19	17	21
3	95		17	17	17	17	19	21	21	19	21
4	94		16	16	16	16	17	20	20	19	19
5	93		15	15	15	15	15	18	19	18	17
6	91		13	13	13	13	13	14	15	15	13
7	87		8	8	8	8	8	8	8	8	8
8	85		6	6	6	6	6	6	6	6	6
9	83		3	3	3	3	3	3	3	3	3

*See Table 14, Chapter 13, THE GUIDE 1953.

nation of weather conditions that is fairly typical of the Cleveland area. The low wind velocity is typical of the conditions under which most of the experimental work was done.

Dotted curves give the calculated gain due to transmitted solar radiation and the calculated gain due to convection and radiation from unshaded glass No. 2. The third dotted curve gives theoretical shade factors for a slat absorptance of 0.4. These values are compared with values based upon the experimental observations. Test values are close to the calculated values during the most important part of the day, but high at the beginning and end, when a few Btu per (hr) (sq ft) make a large percentage difference. Differences can be attributed to experimental error, to the fact that heat storage rates of glass and shade were not taken into account in computing the theoretical shade factors, and other factors.

It must be emphasized that the *heat gain values are instantaneous rates of heat gain.* In practical situations, *heat storage of the internal structure must be considered* in determining the contribution of solar heat gains to cooling system load.

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Discussion

E. W. Conover, Detroit, Mich. (Written): We wish to commend the authors for their efforts in presenting the data and examples more clearly and simply than in other papers resulting from this project.

Upon reading this paper I find that most of the comments that I made on the original draft have been considered by the authors. However, a few questions arise that I would like to have answered.

It is stated that the surfaces of most painted slats in present use can be classed as diffuse reflectors. My observation is that most of them, particularly the metal ones, appear to have considerable specular reflection. Were the factors determined from test on slats or calculated on the basis of diffuse surfaces?

Items 8 of the general discussion states that roughly ½ of the reflected-through component enters the room in a generally upward direction. This might be true if the slat surface is perfectly diffuse, but with some specular reflection it is believed that it will be more than ½ or more nearly the 2/3 as stated in the original draft. What test data or computations influenced the authors to change this to ½?

Under Design Assumptions it is stated that the test data showed that about 25 percent of the incident diffuse radiation came from the ground and 75 percent from the sky. Some surfaces such as snow, cement pavement, sand, dry grass, etc., are brighter than the blue sky with the sun shining on them. I might ask how a 50-50 distribution between ground and sky would affect the design values of absorptance and transmittance.

R. W. McKinley, Pittsburgh, Pa. (Written): The last paragraph in Column 1 on page 134 indicates that 25 percent of the diffuse radiation comes from the ground. Does this include both radiation reflected from the ground and that re-radiated by the ground? If this 25 percent portion is applicable only to these test data, do you propose that it is typical and may be used safely as a design figure?

In the case of a low south-facing window adjacent to a large high reflectance roof or ground area (sun altitude approximately 45 deg) I would expect that the diffuse component reflected might easily approach 75 percent of the direct solar radiation. In addition, it seems that the re-radiation to a window might be of important magnitude after the temperature of such a nearby radiating panel had been raised by continuous exposure for a period of several hours.

Is this condition taken care of by these design data? If these factors are not included in the procedure proposed in the paper, how may they best be handled? The matter is mentioned in paragraph No. 9, p. 132, and in paragraph 1, page 133. Is this radiation also considered in The Guide 1953, Chapter 13, Table 6, used in Example 2?

C. M. Humphreys, Cleveland, Ohio, referred to the able contributions of R. A. Miller, to the work of the TAC on Heat Transfer Through Glass during the period when investigations on solar radiation, heat transfer through glass, and effect of shading devices, had been carried on at the ASHVE Research Laboratory.

W. A. Danielson, Raleigh, Tenn., inquired whether the authors had any information on the heat gain that would be obtained if the slats had been sloped upward towards the outside at the 45 deg angle.

R. A. Miller, Pittsburgh, Pa., stated that a closure prepared by the authors would be published later.

J. P. SOULE RETURNS FROM NAVY

John P. Soule, a member of ASHVE, has been appointed Engineered Products Specialist, Northeastern Division, American Radiator & Standard Sanitary Corp. with headquarters in New York City. Mr. Soule has been on military leave of absence with the Navy during the Korean emergency.

Research Administration Symposium†

Participation by the Colleges in Engineering Research

By Eric A. Walker, State College, Pa.

THE GROWTH of research in the United States has been concentrated in the last 10 years with Government sponsored projects alone increasing from $350,000,000 in 1940 to 1.3 billion dollars in 1952, exclusive of atomic energy work. The Congress set up a National Sciences Foundation in 1950 to sponsor fellowships and programs in basic research. The Army through its Office of Scientific Research, and the Navy through the Office of Naval Research have supported basic and applied research. The grants of these three organizations have been made primarily to universities and colleges.

There have been colleges of engineering in this country for about 125 years, most of which started with courses in civil engineering and which have gradually encompassed many other fields because of scientific discoveries and the needs of industry. The professional requirements of engineering and the engineering societies have exerted a strong influence on the curricula, and thus the engineering courses have been designed primarily to prepare men for professional competence.

In recent years there has been a strong movement, both without and within the engineering profession, to encourage engineers to contribute more completely to the progress of society. This criticism appears unwarranted. However, the pressure has called for the addition of courses in the humanities to the engineering curriculum.

There is a feeling that many engineers are too narrow scientifically. This belief has arisen because as science has advanced, its fields have broadened and many major projects will involve several branches of engineering. *For example*: a large industry has grown up in recent years to produce devices for the electrostatic precipitation of air-borne solids; an electrical engineer who solved the initial electrical problems was soon confronted with the structural problems (the suspension of huge plates and wires and their attendant vibration). The solving of electrical, mechanical and structural problems did not solve the problem of air flow so that aerodynamics had to be considered. Many companies today would prefer that the colleges teach the engineering students the fundamentals and the industry can train the men to apply their knowledge.

Some colleges have already established courses in engineering science, engineering physics, and it seems possible that the colleges might be wise to consider establishing courses in research, development, construction, materials and sales rather than civil, mechanical, electrical, etc. It is believed that the body of information and amount of learning to which a successful engineer should be introduced has grown so rapidly that a four-year course is insufficient to prepare the average engineering leader. This may account for the disparity between starting salaries paid to men with bachelor's degrees and those with doctorates. It is evident that most young men coming out of engineering schools today do not have the proper techniques for a career in research since they do not understand the scientific method. This problem of teaching research techniques has been solved to some degree in law and medicine by advanced training followed by internship. Many colleges have this internship for scientists and engineers, unknowingly perhaps, when they assign to an investigator a number of graduate students who do much of the

E. A. Walker
State College, Pa.

• ERIC A. WALKER — Dean, School of Engineering, Pennsylvania State College. Dean Walker was formerly Executive Secretary of the Research and Development Board. At the college he is director of the Ordnance Research Laboratory and Head of the Electrical Engineering Department. He received his BS, MS, and ScD degrees from Harvard University. Dr. Walker was associate director of the Underwater Sound Laboratory at Harvard during World War II, and in addition was associated with the Office of Scientific Research and Development. In 1950, Dr. Walker was appointed as deputy chairman of a weapons panel of the National Research Council.

†Abstracts of addresses given at the Research Administration Symposium at the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, January 1953.

detail work. There is a great deal of discussion as to the definitions for pure, basic, fundamental, background and other types of research. Such definitions are neither easy to define nor are they usually correct. A recent definition for research was: *basic research is man's search for an understanding of the physical world.* This definition went further and stated that research could only be divided into *significant* and *insignificant* research. The colleges and universities should devote their efforts to *significant* research which fulfills the definition just given.

College research in recent years has grown tremendously, together with the realization that research and its results cannot be multiplied by merely increasing budgets; efficient organizational structure is necessary. Some colleges operate their research through the teaching department heads which generally is an inefficient method of operation. More and more colleges are turning to Departments of Research or Engineering Experiment Stations or Research Institutes which are set up separately from the teaching departments. In some schools the research function is completely separate from the teaching operations, with separate corporate bodies governing the conduct of the research. In some of these cases colleges have been criticized for doing commercial research work.

Colleges should use careful accounting methods to be certain that the funds donated or assigned for research are applied only to research work and that funds for teaching purposes are separated. This would eliminate confusion concerning costs.

By assigning good men to problems which are basic in nature and giving them a small number of assistants and graduate students who can profit by the guidance of a skilled master, universities will be able to train the students in the techniques of research and enhance the position of the university. It is the job of the Government and of industry to help safeguard industrial research, not only because of its results, but because of the new scientists who are trained to carry on future work.

Government Sponsored Research — A Canadian View

By R. F. Legget, Ottawa, Canada

THE PARTICIPATION of Government in research has been an accepted fact for some time in Canada and there is a happy integration of research by Government, industry, and universities. As in other countries, Government research in Canada began in the field of agriculture in association with universities and agricultural colleges. Other research fields with long-standing Government participation include forestry, mines, fisheries, and more recently the Department of National Health and Welfare.

In recent years many of the provinces have set up their own research organizations and maintain their own laboratories, and here research for the smaller industries is performed. In Canada Federal research is under the direction of the *National Research Council of Canada* which was set up in 1916. It consists today of 20 recognized leaders in the research field in Canada. Among the duties of the Council is to stimulate research work and thus increase the number of trained research workers. Through associate committees served by representatives from Government, universities, industries and labor, coordination of research activities has been attained.

The demands of World War II were a challenge to the council, and resulted in a staff increase of more than 3,000 by the end of the War. The research staff operates through the divisions of chemistry, physics, applied biology, mechanical engineering (aeronautical engineering), radio and electrical engineering and building research. The council now has laboratories at Saskatoon, Halifax, and Ottawa. The director of each division reports to the council president who in turn reports to the chairman of the Privy Council, most of whom are members of the Federal Cabinet. Funds for the operation of the council are voted upon annually by Parliament.

The Division of Building Research published the National Building Code in 1941, although actual building research was delayed until 1947. The function of the division is to provide research services to the construction industry and advance building techniques in Canada. Housing research is the dominant responsibility of the division, together with the ever current revision of the National Building Code. The division has grouped research problems under several headings including cold weather problems of the far North; permafrost; fire research; foundation and soil problems; and

R. F. Legget
Ottawa, Canada

• R. F. LEGGET — Director, Division of Building Research, National Research Council. A graduate of the University of Liverpool with a Master's degree, Mr. Legget was formerly with a consulting firm in Westminster. He came to Canada in 1929, and served as Resident Engineer for a large Canadian hydro-electric plant. He taught at the University of Toronto before joining the Research Council and has done consulting work on many special foundation and soil problems. He is a member of the Institute of Civil Engineers, ASCE, and a Fellow of the Geological Society of America.

problems associated with snow and ice. The division does not undertake studies without consulting with and cooperating with other organizations and laboratories. The division has placed special emphasis upon building practice work, collecting information on research work already completed, and handling inquiries which come to the council and which lead the way for further research. The current division budget is about $500,000. Projects for the divisions are paid for both from Council funds and jointly with industrial groups.

Under the National Research Council, research is a separate and distinct function of Government, and thus the operations can be maintained in an objective manner. The problem of securing personnel plagues the organization. Salaries are good by comparison with previous years, but are at a serious disadvantage when compared with industrial wages. The problem of replacement of men in the scientific field who leave the Research Council for industry jobs is indeed difficult. Even with these problems the division has managed to recruit a competent staff who have been conscientious and whose tenure is an indication of the role of the council in the Canadian community.

Government sponsored research in Canada is research paid for out of public funds, subject to financial control by the Parliament, and always conducted in close contact with industrial and university research work. Its objective lies in the improvement of the utilization of material resources, and in standards and equipment for the physical basis of the lives of all Canadians upon which the well-being and progress of the country ultimately depends.

Industrial Research in the Control of Environment

By Waldo H. Kliever, Minneapolis, Minn.

RESEARCH IS the means of industrial progress. At one time curiosity was the motivating force which led to scientific discovery; however, today theory and experimental techniques have been combined to improve research and development. Higher wages and taxes have increased the importance of improved efficiency of production. The objective of industrial research is to provide new products and improvement in products to sell at a profit.

Research programs should not be limited to details of improvement of present devices, but should include a study of complete systems to determine whether they are based on correct fundamentals. The management of a company will ordinarily define the general fields of the company's activities, and research projects will be evaluated against these general objectives. Different organizations have various methods of obtaining ideas for possible research projects. The research laboratory of one company sends a letter to the chief engineer of each of its divisions asking in effect, *What is needed by your department?* The problem of the selection of projects is an important one and consideration should be given to the possibilities of marketability, cost, and time limits. The availability of facilities and personnel is important and the probability of a successful solution to the problem should not be overlooked.

The budget for research within a company might well be determined by a study of the projects which are deemed to be worthwhile, and an estimate made of their cost.

The division of funds between research and product development is one of the most difficult in research administration. Any research effort should be built on a sound appreciation of the importance of basic research. To quote Dr. Vannevar Bush:

> Basic Research is performed without thought of practical ends. It results in general knowledge and an understanding of nature and its laws. This general knowledge provides the means of answering a large number of important practical problems though it may not give a complete specific answer to any one of them. The function of applied research is to provide such complete answers. The scientist doing basic research may not be at all interested in the practical applications of his work, yet the further progress of industrial development would eventually stagnate if basic scientific research were long neglected.

No amount of applied research on the improvement of electronic vacu-

W. H. Kliever
Minneapolis, Minn.

• W. H. KLIEVER — Director of Research, Minneapolis-Honeywell Regulator Co. He is a graduate of Bethel College with an AB degree in chemistry. While doing research and development work on precision laboratory instruments for the Gaertner Scientific Corp., he received his PhD in Physics from the University of Chicago. Dr. Kliever was with the U. S. Cotton Ginning Laboratory until 1940 where he developed several special instruments for studying cotton gins and presses. At Minneapolis-Honeywell since 1940, he developed a number of aeronautical control devices.

um tubes would ever have produced a transistor which is more efficient and reliable yet far smaller than the vacuum tube.

The most important factor in any research program is that of personnel who must be capable of an analytical approach and yet be original in their thinking. Their work should be encouraged in an atmosphere of freedom of thought and appreciation for the results of their efforts. Research should be separate from product development as research is the creative function to analyze what a company is doing, to question it, to suggest improvements in products or to suggest new products as a result of new information. For effective research administration there are three requisites; (1) good personnel with natural motivation, (2) inform the personnel of the company's problems and objectives, and (3) provide them with suitable facilities and a research atmosphere of freedom.

Discussion

Following the presentation of three aspects of research administration, a number of comments were made by several members of the audience.

Dr. H. B. Nottage, Sherman Oaks, Calif., stated that creative accomplishment springs from the human mind and that a research administrator must be able to give inspiration for the creative energies in the mind. He asked whether the panel thought that the old slogan *opportunity is the best security* was still applicable. Dr. Nottage agreed with Dean Walker's proposals but thought there might be means of doing them better. Dr. Nottage asked what the influence of national policies might be on the problems of educational institutions and what the future holds for university research. He asked Mr. Legget to elaborate on his statement of the catalytic influence of allied sales force. Dr. Kliever was asked to comment on the role of outside consultants.

Cyril Tasker, Cleveland, Ohio, stressed that a major problem of the Society was translating the results of its research into terms that could be understood by its members. These members are, after all, the sponsors of the research. He emphasized his belief in better training to enable the engineer to express in relatively simple terms the results of his work. In addition to the difficulty in obtaining trained research men, the problem of finding trained technicians is likewise important. Mr. Tasker believed that many research men could increase their usefulness and results if more competent technicians were available. He stressed the importance of the exchange of information not only among research laboratories but among groups having different ideas and approaches to problems. Mr. Tasker spoke of the importance of giving research men freedom of action, although not license; it is impossible to set a deadline on research results. Mr. Tasker concluded that any success the Society has had in research over the past 30 years has been primarily because many people have been willing to sit down together and exchange ideas for the benefit of their fellow men.

Dean L. G. Miller, East Lansing, Mich. commented on the potential manpower available for research in the average engineering college. Many of the staff have doctor's degrees and most of them are young and with a capacity for a lot of work, although few of them are doing any real research work. He was inclined to believe that there should be an effort made to utilize this manpower and it might be well to consider the matter of incentive. The granting of additional monetary compensation might be one way of increasing research work among college engineering staffs.

J. Donald Kroeker, Portland, Ore., asked the chairman of the ASHVE Committee on Research to outline the relationship of the Society research to the types of research which were discussed by the panel.

I. W. Cotton, Indianapolis, Ind., stated that it seemed to him that the Society research should work with and utilize contacts with industrial, scholastic, and governmental research organizations. He stressed that the average industrial organization is concerned with improving existing products or improving production methods to decrease costs, and is ordinarily not concerned with the basic scientific facts underlying the product or its utilization. The purpose of Society research, according to Mr. Cotton, was to study basic facts which would enable an engineer to design and properly utilize equipment. As an example of Society research Mr. Cotton described the exhibit at the 11th International Heating, Ventilating and Air Conditioning Exposition of the ASHVE in cooperation with the United States Public Health Service and the University of Illinois. This exhibit was a demonstration of the environmental effects of air conditioning equipment. Mr. Cotton maintained that the manufacturers are vitally interested in the results of this type of research. As a result of the studies at the University of Illinois, it has been proved that the effects of going from a properly air conditioned space to a normal outdoor environment in the summer time are not harmful to healthy people. In conclusion Mr. Cotton stated that he felt that manufacturers, scientific institutions, and the government would agree that research by the ASHVE is needed as much as the Society needs and utilizes the research of these three groups.

V. L. Miller, Pittsburgh, Pa., emphasized the importance of having engineers with imagination who are willing to put their ideas to work. In the training of students in engineering schools it is important to develop in the students the idea that imagination and curiosity are important. Mr. Miller submitted that research is one of the most important things that any organization has to do. He stated further that the organization of the Society laboratory in 1919 was the result of imagination.

R. A. Sherman, Columbus, Ohio, reiterated the statement of Dean Walker that research has become big business only since 1941. In the same way industrial research which is roughly equal to governmental research has also been stimulated because of war in that companies can do research with money that would otherwise go for taxes. Mr. Sherman hoped that this tremendous growth of research and its results have convinced industry and the people that research will be necessary even when it is more expensive. Mr. Sherman felt that because of the tremendous amount of research being done by various defense agencies of the Government that no one person can know all that is going on. He felt that good work is best stimulated by a sponsor who, after putting up the money for a project, looks forward to his monthly or quarterly report and who visits the research institution periodically to study the results. In Government research such visits are often not made and this lack of stimulation is apparent in the results. Mr. Sherman emphasized that work on Government projects is just as vital since it is the people's money that is being spent.

L. N. Hunter, Johnstown, Pa., asked Dean Walker whether it was the responsibility of the educational institutions to train their graduates to conduct research projects or is this the job of the employer?

In his closing remarks Dean Walker described two organizations whose efforts are devoted to the mechanics of organization research. These are the *Industrial Research Institute* and the *National Conference on Research Administration;* this

latter group is made up of one-third Government people, one-third university people and one-third industry groups who meet each year for a three-day conference on research administration. The biggest unknown in any research program is, of course, the human element, and this is recognized by most research administrators.

Few colleges can teach a man research in a four-year course. The thesis has almost disappeared from the college curricula and will soon be gone from the master's curricula, according to Dean Walker. He believes that the only teaching at the research level will have to come while a man is obtaining his doctorate. Dean Walker said that the growth of the number of post-graduate fellowships from industry, government and foundations would provide a strong hedge against a collapse in research when the war stimulus ends. It was his opinion that research in colleges will grow to a much greater extent in the next 20 years.

Dean Walker pointed out that many men in engineering schools who obtain B.S. degrees are not and never will be engineers. Many of these men might do better to take a course which would train them to be technicians to supply the need described by Mr. Tasker. Dean Walker questioned whether the large number of engineering teachers mentioned by Dean Miller were actually capable of doing creative research. He stressed the fact that in 1950 six colleges in this country had more than 50 percent of the Government money for research and development. It is difficult to start research where it has not flourished. This is true in industry as well as colleges. Dean Walker emphasized that the Government has ways of burying reports, often under the cloak of security which is not justified.

Mr. Legget in his closure replied to the question of Dr. Nottage concerning the catalytic influence of an allied sales force. According to Mr. Legget, Government sponsored research publicity is a difficult matter, and, without the influence of a sales force, Government sponsored research is not well known even within the Dominion. Mr. Legget emphasized that Government research in England began as a direct result of the defense needs of the first World War and the same forces influenced the beginning of the *National Research Council of Canada*. Today in Canada there is a Defense Research Board to handle defense research, leaving the *National Research Council* and other agencies to carry on their normal work.

Mr. Legget concluded his remarks with a definition of research which came from a Scottish theologian: *Research means asking the right question and appreciating the right answer. This means being both humble and alert.*

Dr. Kliever closed the discussion remarking on the help which has been forthcoming from the Society's laboratory and its various committees. He mentioned the importance of communication between the laboratory and the various divisions of a company. He also emphasized the importance of keeping it on an informal basis. Dr. Kliever was opposed to the locking of laboratory doors because, as Kettering has said, *When you lock the door you lock out much more than you lock in.* Dr. Kliever stressed the importance of the human element and the necessity of maintaining an interest in each man's work and the exigency occasionally to remove a man from research when it is definitely established that he does not have the proper ability. Often this will result in a man finding much greater success in other endeavors. He stated that consultants were often used to assist in projects for which an organization did not have the necessary background or facilities.

He pointed out that the Armour research group had discovered that over half of their projects came from organizations which have large research facilities of their own. Dr. Kliever was of the opinion that the War was not necessary to obtain good research as research dollars are spent about as inefficiently as other dollars during a War. Dr. Kliever was optimistic concerning the prospects of industry continuing to support research even without tax dollars. In his opinion research is something that brings a company definite returns and is not just a necessary evil.

LONG-RANGE PLANNING COMMITTEE APPOINTED

At the June Council meeting the members of the Long Range Planning Committee were selected as follows: from Council — John E. Haines, Minneapolis, Minn.; P. B. Gordon, New York, N.Y.; and John W. James, Chicago, Ill.; from the membership at large — A. J. Hess, Los Angeles, Calif.; J. Donald Kroeker, Portland, Ore.; and Dean L. E. Seeley, Durham, N. H.

John E. Haines
Minneapolis, Minn.

P. B. Gordon
New York, N.Y.

CHAIRMAN J. E. HAINES, second vice president of the Society, joined the ASHVE in 1940 and has been a member of the Council since 1950. He has served on the following Society committees: Chapter Delegates, 1945-46; Nominating, 1945-46-47 and 1948, serving as chairman in 1947; Chapter Relations, chairman, 1950-51; Ways and Means, 1951; Membership, chairman, 1952; and Promotion of Research, chairman, 1947-49. Mr. Haines served as president and vice president of the Minnesota Chapter, 1946-47 and 1945-46, respectively. He has lectured extensively on automatic controls and is the author of *Automatic Control of Heating and Air Conditioning* published in August, 1953.

P. B. GORDON has taught at both NYU and Princeton. He joined the Society in 1934 and has been active on many of its committees including the following: Guide Publication Committee, 1949-51, serving as its chairman in 1951; Chairman, TAC on Panel Heating and Cooling, Group A, 1949; TAC on Panel Heating and Cooling, 1947-51; serving as its chairman in 1949-53; Committee on Research, 1950; Program and Papers Committee, 1952-53; Building Committee, 1953; and the Standards Committee, 1953. A member of the Council since 1951, Mr. Gordon was president of the New York Chapter in 1952.

A. J. HESS has been a member of the Society since 1937 and is associated with the Southern California Chapter, having served as its president in 1947. Among the many committees on which he has served are the following: Committee on Promotion of Research, 1947-48; Chairman of the Chapters Conference Committee in 1952; Chapter Relations Committee, 1950-52; Research Committee, 1950-53; TAC on Sensations of

A. J. Hess
Los Angeles, Calif.

John W. James
Chicago, Ill.

J. Donald Kroeker
Portland, Ore.

L. E. Seeley
Durham, N.H.

Comfort, 1949-53; TAC on Corrosion, 1950; Chairman of the TAC on Evaporative Cooling, 1953; and Chairman of the TAC on Plant and Animal Husbandry, 1953. Mr. Hess has also contributed extensively to engineering and technical publications.

JOHN W. JAMES is known to many Society members for his eight years association with the ASHVE as Technical Secretary and currently as Treasurer. A member of the Society since 1933, he is presently on the Council's Executive and Finance Committees. Now a member of the Illinois Chapter, he was president of the Northern Ohio Chapter in 1947. Mr. James' service to the Society includes participation on many committees among which are: Guide Publication Committee, 1944; Committee on Research, 1944-45; 1947-49, serving as chairman in 1949; TAC on Panel Heating and Cooling, 1947-52, serving as chairman of Group B, 1947-49; and TAC on Hot Water and Steam Heating, serving as chairman in 1951-53. He is co-author of a textbook, *Heating and Air Conditioning;* was associate editor of the 1949 edition of the *Handbook of Oil Burning;* and is the author of many engineering articles.

J. DONALD KROEKER joined the Society in 1936, served as Treasurer in 1952 and was on the Council from 1948-51. Other Society positions in which he has served include: Finance Committee of the Council, 1952; Chairman of the Standards Committee, 1950; Nominating Committee, 1941-42 and 1946; Chapter Relations Committee, 1948; TAC on Weather Design, 1945; TAC on Heat Pump, 1950-53; and the F. Paul Anderson Award Committee. An active member of the Oregon Chapter, he served as its first president in 1939. Mr. Kroeker has presented several papers on heat pumps at Society meetings.

DEAN L. E. SEELEY was president of the Society in 1951. A member of the ASHVE since 1930, he served on the Council from 1944-51 and on its Executive, Finance and Standards Committees. Among the many Society positions in which he has served are: Chairman of the Publication Committee, 1946; Treasurer of the Society, 1948; Second Vice President of the Society and Chairman of the Finance Committee, 1949; Executive Committee of the Council and Special Federal Liaison Committee, 1949; and First Vice President and chairman of the F. Paul Anderson Committee in 1950. In addition he was a member of the TAC on Human Calorimetry in 1950 and through the years has served on numerous Research Technical Advisory Committees. Dean Seeley is the author of numerous technical codes and papers which have been published in the Society's Journal and Transactions.

The Committee was instructed to make the necessary studies to prepare and recommend to Council long range planning on future aims and activities of the Society, including recommendations on the Society's objectives as specified in Section 4 of its charter, as well as any other items which in the opinion of the committee would affect the future welfare and growth of the Society.

The members were called together by Pres. Reg. F. Taylor in Denver on July 1, 1953 and John E. Haines was chosen as chairman of the committee.

The committee discussed the various fields of Society interest and activities and assigned one or more subjects to each member for study and analysis.

The committee plans its next meeting in September.

Honored by Life Membership

ALBERT A. AHLFF, president, Albert A. Ahlff & Co., Inc., Kirkwood, Mo., joined the Society in 1918 as an Associate and was advanced to Member in 1923.

A. A. Ahlff
Kirkwood, Mo.

Born on June 18, 1887, at Ground Mound, Ia., Mr. Ahlff attended Iowa State College while working as a steam fitter's helper. His business experience includes a diversity of activities. From 1920-25 he was a salesman for the U. S. Radiator Corp. in Minneapolis, Chicago and Washington, D.C. and later became branch manager of the Buffalo office. For the following six years, he was with the Spencer Heating Co., Buffalo, N.Y. and served as branch manager in the New York City office. In 1933

Honored by Life Membership *(continued)*

he joined Chase Brass and Copper Co., Waterbury, Conn., as manager of the heating division and remained with that firm for three years.

In 1937 Mr. Ahlff became Philadelphia branch manager for The National Radiator Corp. and from 1939-42 he was in charge of Engineering, Design and Sales for Tuttle & Bailey, New Britain, Conn. He was a special representative for the Hajoca Corp., Philadelphia, and served on the Extended Heating Surface Division of the War Production Board during 1942-46. Mr. Ahlff went into business for himself in 1947 and has been president of Albert A. Ahlff since that date.

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AUBREY I. BROWN — Professor of Mechanical Engineering, The Ohio State University, Columbus, Ohio. Professor Brown devoted 40 years to teaching engineering and served as chairman of the Department of Engineering at The Ohio State University from 1906-52, when he resigned from administrative duties to devote full time to teaching. He has also served as consultant on heating, ventilating and air conditioning for various Ohio concerns, state and county offices and for the *Association of American Railroads*. Professor Brown is co-author with S. W. Marco of the textbook, *Introduction to Heat Transfer*.

A. I. Brown
Columbus, Ohio

A member of the Society since 1923, Professor Brown has contributed to several editions of THE GUIDE. He served from 1935-37 on the Publication Committee of the Society and since 1947 on the TAC on Heating Load. Professor Brown was born in Wolfville, Nova Scotia, attended Acadia University from 1906-08 and was graduated in mechanical engineering from The Ohio State University in 1912. He is a member of Sigma Xi, Tau Beta Pi, Pi Tau Sigma and a number of national technical societies.

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A. E. BASTEDO, vice president and treasurer, Burnham Corp., Irvington, N. Y., became a Life Member recently, 34 years after having joined the Society in 1919.

Born in 1888 at Hastings-on-Hudson, N.Y., Mr. Bastedo received his education at the local high school. He joined Lord & Burnham Co., Irvington, N.Y. in 1906 and later became manager of the Boiler Department. The company was reorganized in 1920 and assumed its present name, Burnham Boiler Corp. He became its vice president and treasurer in 1934. Throughout his career Mr. Bastedo has specialized in designing steam and hot water heating plants and drafting low pressure heating boilers.

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J. J. HAINES, president, The Haines Co., Chicago, Ill., joined the Society in 1915. Born on May 24, 1888, in Toronto, Ont., Canada, he attended Ordinary Home School and Crane Technical High School.

Mr. Haines was a clerk at both Marshall Field & Co. and at the Standard Oil Co. in Chicago before he began his career in 1906 with The Haines Co. He started as an estimator and rose through the years from secretary to vice president and finally to president. Mr. Haines has been president for more than two decades and is still as active as ever.

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ALFRED J. OFFNER — Retired, Beechhurst, N.Y. A past president of ASHVE, Mr. Offner was recently honored by elevation to Life Membership. He was born and educated in New York and holds degrees in B.S. and M.E. from Cooper Union, where he also taught advanced physics for five years.

Alfred J. Offner
Beechhurst, N.Y.

Mr. Offner started his career in the consulting field with Konrad Meier and for many years was also with Henry C. Meyer, Jr. In 1919, he organized the firm of Offner and McKnight. He opened his own office in 1923 and specialized in design and mechanical equipment for business buildings, large residences, churches, and the Army and Navy.

Always active in the Society, he served as Treasurer from 1938 to 1939. Included among the committees for which he was chairman are the Admission and Advancement, Guide, and Finance Committees. At present, he is chairman of the Building Committee. Mr. Offner has also been prominent in the affairs of the New York Chapter and served as its president in 1930 and was also a member on the Board of Governors.

A member of the *New York Association of Consulting Engineers* and its president in 1936-37, Mr. Offner has also written extensively in the field of heating and ventilating.

When the ASHVE Went Western

Pres. Reg. F. Taylor accepting cowboy hat from Judge Wilson McCarthy, president, Rio Grande Western Railroad

Mr. & Mrs. W. G. Boales, Detroit

Junior cowboys and cowgirls — Betty Evans, Patsy Hunter, E. T. Grady, Dorothy Glancy, Johnny Glancy, Mike Noble

"Western Dudes" — Jack Everetts, Jr., Neil Peterson, E. R. Queer

Mrs. L. L. Hamig, Mrs. Cary Gamble, Mr. Gamble, Mrs. E. A. Thompson, Mr. Hamig

Mrs. Reg. F. Taylor, P. B. Gordon, Mrs. Gordon, Mrs. J. R. Wilson, Mrs. D. R. Bachman

R. A. MacGregor, R. T. Kern, E. L. Weber, Mrs. J. C. Harrison, Mr. Harrison

(Pictures through courtesy of W. V. Burbank, Denver, and W. M. Wallace, II, Durham, N.C.)

Houston Beckons in January '54

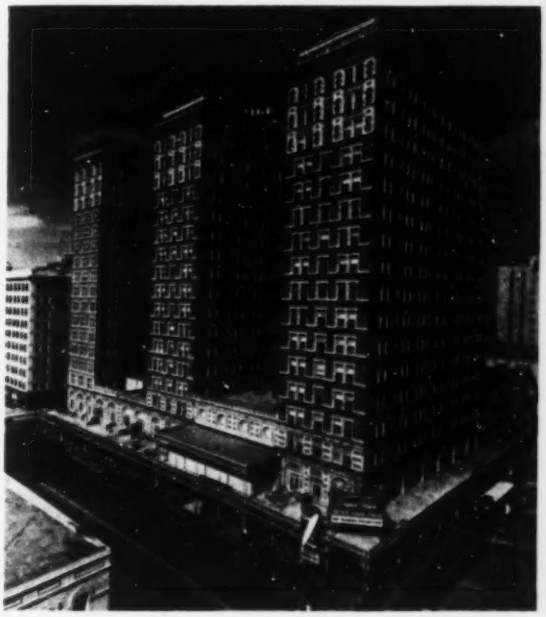
HOUSTON, claiming to be the most thoroughly air conditioned city in America, will be the scene of the 60th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, January 25-27, 1954, with headquarters at the Rice Hotel.

Society Pres. Reg. F. Taylor and his associates in the South Texas Chapter will serve as hosts for the Meeting. D. M. Mills, general chairman of the Committee on Arrangements will be assisted by R. J. Salinger, vice chairman.

Plans are already underway for the program and entertainment features of the meeting. Prof. B. H. Spurlock, Jr., chairman of the Program and Papers Committee, promises that the technical sessions will include many outstanding papers on a diversity of subjects. In addition to the presentation of research and engineering papers by leading authorities in the field, there will be reports from the Society's Research Laboratory.

Easily accessible from all parts of the country, Houston possesses an excellent transportation network of seven domestic and three international air carriers, seven railroad systems and five major bus lines. Often referred to as the *Nation's Fastest Growing Metropolitan City*, Houston has a large number of varied attractions to offer Society members. Topping the list are the Battleground and San Jacinto Monument and the Battleship Texas. Other points of interest include the beautiful homes and rare gardens, ever-expanding skyline, tremendous industrial and port area, oil fields and cattle ranches. Houston's proximity to the hill country of Texas, the Gulf Coast Area and Old Mexico also present outstanding possibilities for unusual and exciting tours.

As always, there will be many events of special interest to Society members and their wives, including an entertaining schedule of ladies' activities.



The Rice Hotel Headquarters for 60th Annual Meeting

According to a survey made in 1951, 21,527.9 tons of refrigeration were installed for air conditioning. Houston also boasts of 3860 air conditioned hotel rooms.

It is suggested that members immediately mail the official hotel reservation forms to the hotels of their preference in order to obtain choice accommodations. These reservation forms will be mailed to reach members in September.

President Taylor, the entire South Texas Chapter and the Committee on Arrangements are eagerly looking forward to welcoming Society members, their wives and guests to Houston for the 60th Annual Meeting in January. Plan on going "down south" to Houston this winter.

Committee on Arrangements

D. M. Mills, *Chairman*
R. J. Salinger, *Vice-Chairman*

Banquet—W. N. Pauley, *Chairman;* J. A. Wheeler, D. M. Robinson, A. B. Ullrich, A. M. Chase, Jr., J. N. Powell.
Entertainment—F. M. Neil, *Chairman;* N. L. Brown, D. S. Freese, M. E. Linn, H. E. Hope, Jr., O. G. Rivoire, Wesley Brown, D. C. McNeil, Reese Brentzel, H. R. Safford.
Finance—A. J. Natkin, *Chairman;* Willard Ammons, J. A. Poole.
Ladies—C. L. Fleming, *Chairman;* C. C. Quin.
Publicity—B. P. Fisher, *Chairman;* Wayne Holland, W. J. Way, II, B. J. Beaird, C. W. Warren.

Honorary Chairmen
C. R. Gardner, Fort Worth, W. E. Long, Austin

Reception—E. G. Floeter, *Chairman;* Sidney Bromberg, H. O. Williams, J. C. Lewis, M. B. Peiser, G. T. Kerbow.
Sessions—I. A. Naman, *Chairman;* J. B. Buckley, W. L. Lashley, Jr., Bruce Appling, J. C. Fontana, Dallas Sullivan, G. D. Hines, Norman Rosenberg, S. F. Atlas.
Special Events—H. W. Broadwell, *Chairman;* B. P. Fisher, D. S. Cooper, F. R. Young, J. H. Stephenson, M. B. Peiser, H. G. McKee.
Transportation—A. P. Barnes, *Chairman;* A. E. Hess, C. V. Chenault, A. B. Banowsky, R. S. Sandifer, D. W. O'Brient.

Summary of Chapter Meetings*

MISSISSIPPI CHAPTER RECEIVES CHARTER

The Mississippi Chapter, the newest Society Chapter, received its Charter on May 25, 1953, in the Walthall Hotel, Jackson, at a dinner meeting.

Society Pres. Reg. F. Taylor presented the Charter to Pres. Burt Lomax, Jr. and the official record books to the secretary. The ceremonies also included the presentation of an inscribed gavel to the Chapter as a gift from the South Texas Chapter. It was requested that the custom of presenting new chapters with gavels be revived. This obligation was accepted by President Lomax.

Among the distinguished guests at this meeting were Professor Holmes, Department of Mechanical Engineering, Mississippi State College, State College; Robert Young, president of the *Mississippi Society of Professional Engineers;* M. L. Brown, membership chairman of the South Texas Chapter of the Society; and Walter Cooke, president of the Delta Chapter of the ASHVE. In addition, there was a guest speaker, Mr. Briley, York Corp., York, Pa. who gave a very interesting and informative talk on *Industrial Air Conditioning* which he illustrated with slides.

Members elected to serve as officers for the first term are as follows: *President* — Burt Lomax, Jr.; *Vice President* — O. F. Rogers; *Secretary* — J. G. Coleman, Jr.; *Treasurer* — I. E. Rowe; *Board of Governors* — Robert Porter, R. E. Vernon and J. W. Taylor. Attendance 32.

• *ARKANSAS:* Vice Pres. R. E. Blaylock introduced the guest speaker, Pat Krapfl, Servel Co., who spoke on *Absorption Refrigeration Systems.* A lively question and answer period followed.

J. L. Brown gave the treasurer's report, followed by the distribution of the new rules for the membership drive.

The June meeting was called to order by Vice President Blaylock at the Sam Peck Hotel, Little Rock. Attendance 22. Attendance ratio 0.29.

• *EMPIRE STATE CAPITAL:* The June meeting, which was the last dinner meeting of the season, was presided over by Pres. N. W. Burrill. It was announced that the next meeting would be held in September.

Members of the Chapter expressed their sorrow on the passing of ASHVE Director of Research, Cyril Tasker, and approved of the secretary's letter to Mrs. Tasker.

The following committee chairmen were heard from: Harry Horowitz—membership; E. J. Mahoney—publicity; and E. C. Doyle—programs.

President Burrill appointed a committee of three members to study and submit revised by-laws to the secretary who will send them to Society headquarters for approval. The committee includes: Past Pres. R. B. Taylor as chairman, C. F. Batchelder, and F. A. Weinbender.

It was agreed to send flowers to H. A. Bond who is seriously ill. Attendance 28. Attendance ratio 0.40.

• *KANSAS:* At the May meeeting of the Kansas Chapter the following officers were unanimously elected for 1953-54: *President*—R. L. Pennington; *Vice President*—Charles Yoe; *Secretary*—O. B. Strahm; and *Treasurer*—T. L. Roberts. In addition to the four Chapter officers elected to the Board of Governors were O. P. Bullock, R. F. Bauer and E. C. Blood.

Guest speaker J. W. Kice, assistant national sales manager, The Coleman Co., Wichita, Kans., gave a very interesting talk on *Residential Air Conditioning.* This was accompanied by a film and followed by a discussion period. The meeting was presided over by Pres. O. P. Oakle. Attendance 23.

• *MASSACHUSETTS:* The May meeting was called to order at the Faculty Club of M.I.T. by Pres. G. B. Torrens. The following officers were unanimously elected for 1953-54: *President*—A. L. Hare; *Vice President*—G. W. Sprague; *Secretary*—W. G. Martin, Jr., and *Treasurer*—W. G. Burbo.

After several committee chairmen gave their reports, the new chapter members were announced as follows: G. W. Monjeau, J. R. Leech and Erlund Field.

The meeting terminated with the presentation of a past president's pin to Retiring President Torrens by John Bonner. Attendance 33. Attendance ratio 0.19.

• *NORTH TEXAS:* The July meeting was called to order at the Melrose Hotel by Pres. P. N. Vinther who introduced the new members, W. F. Markey and A. J. Hackl.

A committee composed of Ross Zumwalt, J. A. Bishop and J. R. Dowdell was appointed to write and

Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

send a resolution bearing the condolences of the North Texas Chapter to the family of the late Dr. F. E. Giesecke. It was also decided to appoint a committee to study the type of memorial that the local Chapter should select in memory of Dr. Giesecke.

E. T. Keck, Jr., introduced the guest speaker, Keith Baker, Chance Vought Aircraft Corp., who presented a film based on the manufacture of airplanes. An interesting discussion period followed. Attendance 90. Attendance ratio 0.40.

• *OREGON:* The feature of the May meeting was a program of Student Papers. Prof. A. D. Hughes was in charge of the presentation of papers and the judges included T. E. Taylor, Walter Hanthorn and T. H. McClung who announced the awards as follows: *First Award* — R. F. Sharp for his paper on *High Temperature Application of the Heat Pump; Second Award* — H. E. Johnson whose subject was *Performance Characteristics of a Capillary Air Washer;* and *Third Award* — R. E. Bulletset who selected as his topic, *Loose Fill, The Economical Underground Insulation.*

Colored slides were shown of last year's picnic followed by discussion of plans for this year's annual picnic.

S. M. Quackenbush proudly presents a past president's certificate to his son John. This is the first time in the history of the Western New York Chapter that a past president was called upon to honor his own son.

It was also decided that a meeting be held on September 10 and that a joint meeting be scheduled for December 4.

The May meeting was called to order by Pres. A. N. Hoss in the Georgian Room of the Heathman Hotel. Attendance 90. Attendance ratio 0.50.

•*PHILADELPHIA:* This meeting was preceded by the Annual Golf Outing at the Melrose Country Club, Cheltenham, Pa. A past president's plaque was presented to Retiring Pres. M. E. Barnard who introduced the new officers. The evening's activities terminated with the distribution of golf and door awards by the golf committee. Attendance 210.

• *SOUTHWEST TEXAS:* The July meeting was presided over by Pres. D. E. Locher at the Belgium Inn, San Antonio. Boone Crisp presented a resolution concerning the founding of a Frederick E. Giesecke Student Loan Fund in memory of the late Dr. Giesecke. He also proposed that the receipts of the Chapter's June Picnic or $150.00 be turned over to the administrators of the fund upon their appointment. Mr. Boone's resolution was unanimously adopted.

The three guest speakers of the evening included the following: Raymond Barnes, consulting engineer, San Antonio, who spoke briefly on the history of the Southwest Texas Chapter; H. W. Broadwell, past president of the Southwest Texas Chapter, who reported on the plans for the ASHVE 60th Annual Meeting to be held in Houston next January; and *Jimmy* Jones of Allis-Chalmers whose topic was liquid pumps. Mr. Jones discussed the size, type and best buy in this field which he illustrated with slides. A lively question and answer period followed. Attendance 43. Attendance ratio 0.42.

ASHVE Chapter Manual

A Manual for Chapter operations of the ASHVE, which has been under development for some time, was approved by the Council at its meeting of June 27, 1953 in Denver, Colo.

This Manual has been prepared under the direction of the Chapter Relations Committee to assist chapters of the Society in planning, organizing and improving their meetings. Copies were sent to chapter officers, together with a supply for their committee chairmen, in August.

The Manual contains four sections. *Section I* is devoted to the duties of officers and the formation and operation of committees. In this section, in addition to the outline of the officers' duties, the duties of the following committees are described: Nominating; Auditing; Membership (duties and aims, organizing the committee, qualification and desirability of member, obtaining new members, broadening the type of membership, advancement to full member, preventing resignations); Program; Attendance; Publicity; Finance; Special Events; Research; Chapters Conference. *Section I* also contains an outline of the duties of officers and committee chairmen for a typical chapter meeting.

Section II is entitled *How to Improve Chapter Meetings*, and contains a definition of a good meeting with some possible defects and suggested corrections; the selection of speakers and subjects for chapter meetings; and the methods of preparing meeting announcements.

Section III is devoted to news releases and publications and the preparation of chapter roster. *Section IV* outlines methods for obtaining publicity for the chapter and its activities.

With the publication of this Manual the Chapter Relations Committee is hopeful that it will fulfill a long standing desire of the chapter for a handbook to guide the chapter officers and committees in the operation of the Chapters.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 56 applications for membership, including 4 reinstatements; in addition 9 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by September 30, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

Alabama

WAYMAN, W. L., Engr., Johnson Service Co., Birmingham. REFERENCES: G. C. Almond, J. R. Potter, H. K. Walden, W. P. West.

California

FRIEDMAN, R. M., Engr., Nelson-Kent Refrigeration, Inc., San Francisco. REFERENCES: John Anselmo*, Joseph Minton, Ralph Torop, Abe Walton*.

△RAYL, L. B., Owner, L. B. Rayl & Assocs., Los Angeles. REFERENCES: N. N. Dahl, L. B. Davenport, A. J. Hess, Stanley Feuer.

District of Columbia

EVANS, B. P., Dist. Repr., The Korfund Co., Inc., Washington. REFERENCES: I. M. Day, G. S. Frankel, L. G. Humphrey, Jr., W. C. Reamy, Jr.

Georgia

JENKINS, J. L., Engr., E. I. du Pont de Nemours & Co., Augusta. REFERENCES: A. L. Berberick*, W. O. Blackstone*, Marcus Durlach, Jr., F. B. Herty.

Illinois

CHEN, C. F., Research Asst., University of Illinois, Urbana. REFERENCES: D. R. Bahnfleth, H. T. Gilkey, S. Konzo, R. W. Roose.

KORTE, D. A., Designer, Edward J. Long, Cons. Engr., Springfield. REFERENCES: C. E. Bretscher*, Gustave Rehm*, Francis Seyfarth*, L. P. Trutter*.

KRANS, D. H., Prof., University of Illinois, Urbana. REFERENCES: M. K. Fahnestock, W. S. Harris, S. Konzo, E. L. Sartain.

†MCQUINN, J. S., Repr., Crum Distributing Co., Decatur. REFERENCES: G. W. Bornquist, A. F. Ferris*, L. L. Hamig, F. W. Thompson.

MOORE, E. B., Dvlpt. Engr., Vapor Heating Corp., Chicago. REFERENCES: J. P. Brennan*, N. O. Kirkby, G. W. Luhrs*, R. W. Poore*.

MURRAY, P. G., Designer, Edward J. Long, Cons. Engr., Springfield. REFERENCES: D. J. Burke, E. J. Long, L. P. Trutter*, E. C. Worthington*.

ZACH, R. E., Jr. Engr., York Corp., Chicago. REFERENCES: R. L. Beach, J. R. Hertzler, V. T. Kartorie, R. A. Rose*.

Indiana

GONG, R. F., Trainee, Cummins Diesel Engines, Columbus. REFERENCES: D. S. Clark*, A. S. Hall*, W. T. Miller, F. B. Morse.

GRABHORN, L. M., JR., Estimator, Roland M. Cotton Co., Inc., Indianapolis. REFERENCES: O. E. Cotton, J. T. Hardin, J. W. Jackson, James Sloan*.

Kentucky

△ZANONE, H. A., Mgr., Zanone Engrg. Co., Louisville. REFERENCES: A. L. Eubank*, Clark Kaye, D. J. Rank, Preston Sinton*.

Maryland

△BORNSTEIN, A. B., Partner, William Bornstein Enterprises, Silver Spring. REFERENCES: F. G. Ackerman*, William Bornstein, E. B. Corning*, E. M. Pitt*.

Massachusetts

†CHRISTIE, A. Y., Cons. Engr., West Roxbury. REFERENCES: Adolf Ehrenzeller, F. A. Merrill, C. D. Potter, C. W. Stewart.

Mississippi

ARLEDGE, M. E., Branch Mgr., F. J. Evans Co., Jackson. REFERENCES: A. E. Bradley, Jr., C. M. Broad, D. M. Mills, I. E. Rowe.

STEWART, W. J., Vice Pres.-Secy., Capital Plumbing Co., Jackson. REFERENCES: F. L. Cooper, J. E. Davis, Jr., W. H. Lambeth, James Taylor.

Missouri

CAPKA, C. M., Repr., Brandwine Equipment Co., St. Louis. REFERENCES: N. B. Barsha, M. D. Brandwine, C. E. Hartwein, R. O. Reeves.

FOWLER, C. W., Engr., Armstrong Cork Co., Bldg. Materials Div., Kansas City. REFERENCES: J. G. Barnes, Jr., L. M. Farber, H. E. Gould, Henry Nottberg.

HELLING, R. E., Engr., E. K. Campbell Co., Kansas City. REFERENCES: E. K. Campbell, R. P. Campbell, W. E. Howarth, W. A. Reichow.

MUELLER, PAUL, Pres., Paul Mueller Co., Springfield. REFERENCES: C. H. Burnap, C. E. Perry, C. W. Schumacher, L. E. Zumbehl.

Nebraska

△SEILER, E. N., Mech. Engr., Corps of Engineers, Omaha. REFERENCES: T. E. Davis, M. K. Rush, Verne Simmonds, O. J. Smith.

New Jersey

△MCBRIDE, J. N., Vice Pres., The Frank A. L. Baum, E. T. Best, W. L. Fleisher, Sr., R. V. Garner.
A. McBride Co., Paterson. REFERENCES:

VAN KAMPEN, B. C., Pres., Brown-Van Kampen Inc., Wyckoff. REFERENCES: R. L. Arnold. A. E. Burns, H. P. Morehouse, George Reznor*.

New York

ALTIERI, J. L., Chief Field Repr., Voorhees, Walker, Foley & Smith, New York. REFERENCES: A. Bass*, H. T. Guerardi*, F. J. Hager*, C. P. Roberts*.

FINCK, H. M., Appl. Engr., Carrier Corp., Syracuse. REFERENCES: R. S. Arnold, Sr., J. H. Carpenter, H. H. Christman, R. A. Church.

KRAMER, B. L., Vice Pres., M. Kramer & Sons, Inc., Albany. REFERENCES: L. V.

Appleby, J. E. Hart, E. J. Mahoney, J. L. Ottenheimer.

KRAMER, Sanford, Secy.-Treas., M. Kramer & Sons, Inc., Albany. REFERENCES: L. V. Appleby, J. E. Hart, E. J. Mahoney, J. L. Ottenheimer.

†WILSON, H. A., Jr., Eastern Mgr., Bohn Aluminum & Brass Corp., New York. REFERENCES: M. C. Barnum*, C. L. Collins*, John Murray*, H. W. Watt*.

North Carolina

SPRINKLE, A. H., JR., Br. Mgr., Crane Co., REFERENCES: M. C. Barnum*, C. L. Collins*, John Murray*, H. W. Watt*. Jr., J. E. Hart, W. H. Sullivan, Jr., Dan Waynick.

Ohio

LYONS, B. M., Engr., Cleveland Electric Illuminating Co., Cleveland. REFERENCES: L. G. Davis*, D. J. Douglas*, R. C. Hienton*, H. A. Lawrence*.

PITTLEMAN, I. H., Engr., General Electric Co., Cleveland. REFERENCES: A. D. Bogen, F. H. Faust, W. F. R. Karsten, Bailey McCreery*.

THORNBURGH, R. B., Dist. Sales Mgr., Surface Combustion Corp., Columbus. REFERENCES: N. T. Hess, W. M. Myler, Jr., J. I. Trimble, R. A. Wilson.

Pennsylvania

△CHAPMAN, W. P., Engrg. Svce. Repr., National Tube Div., U.S. Steel Corp., Pittsburgh. REFERENCES: P. B. Gordon, H. A. Lockhart, T. F. Rockwell, C. D. Shields.

HUMPHREYS, W. Y., III, Appl. Engr., Sturtevant Div., Westinghouse Electric Corp., Pittsburgh. REFERENCES: E. C. Hach, D. B. Hicks, H. W. Rainey, Jr., J. C. Reynolds.

†PROTHEROE, R. A., Gen. Mgr., Losch Boiler Co., Summit Station. REFERENCES: M. F. Blankin, C. B. Eastman, A. J. Johnson, J. M. Kipe.

SCHUSTER, J. E., Engr., Dravo Corp., Pittsburgh. REFERENCES: A. P. Loeb, J. A. Peck, H. A. Pietsch, L. C. Smith.

TEPPER, M. L., Staff Engr., Dravo Corp., Pittsburgh. REFERENCES: A. P. Loeb, J. A. Peck, H. A. Pietsch, L. C. Smith.

South Carolina

MCMURRAY, J. E., Engr., Johnson Service Co., Columbia. REFERENCES: Marcus Durlach, Jr., F. B. Herty, Harry Hoffman, S. T. Oliver.

Tennessee

ARMSTRONG, W. H., III, Regional Mgr., Acme Industries Inc., Memphis. REFERENCES: R. C. Deeg, H. W. Meinholtz, D. G. Merrill*, A. B. Newton.

BOUDOLF, H. A., Engr., Air Temperature, Inc., Memphis. REFERENCES: W. L. Drake, Owen John, R. O. Love, J. T. Pullen.

REED, J. E., Engr., Shelby-Skipwith Inc., Memphis. REFERENCES: John Moore*, C. M. Phelps*, A. W. Shelby, Roy Smiles.

Texas

BROWN, GENE, Mfrs. Repr., San Antonio. REFERENCES: Clarence Franke*, S. A. Gaines*, A. J. Harsch*, Alex Trevino*.

COLLINS, C. D., Engr., W. E. Lewis & Co., Dallas. REFERENCES: W. E. Frost, E. T. Gessell, R. G. Lyford, S. I. Sirmen.

KARBACH, F. W., Partner, Karbach & Engel, San Antonio. REFERENCES: T. P. Christman, Boone Crisp, W. T. Long, L. S. Pawkett.

KOSSBIEL, R. C., Engr., The Blase Co., San Antonio. REFERENCES: John Britt*, C. F. Dickerson, L. S. Pawkett, G. S. Veith.

MARTIN, W. H., Owner, Industrial Refrigeration, San Antonio. REFERENCES: T. P. Christman, Boone Crisp, H. J. Faller, A. C. Leske, Jr.

REESE, R. E., Engr., United Refrigeration Co., San Antonio. REFERENCES: T. P. Christman, Boone Crisp, L. N. Mathis, A. L. Zwally.

SCHLESSINGER, M. W., Chief Engr., Ken Wallace, Inc., Dallas. REFERENCES: Herman Blum, Jr., W. E. Frost, E. T. Keck, Jr., G. A. Linskie.

SLEDZIK, B. J., Dist. Repr., Minneapolis-Honeywell Regulator Co., Lubbock. REFERENCES: M. J. Aderton, O. P. Harlan, Jr., R. A. Mixon, R. L. Patton.

SPEIR, F. M., Pres., Speir & Richardson, Inc., Uvalde. REFERENCES: R. W. Barnes, Boone Crisp, A. J. Rummel, M. E. Staley.

Virginia

△BARBER, R. C., Owner, R. Barber Metal Works, Culpeper. REFERENCES: J. W. Gaddy*, J. J. Quinn*, G. R. Robson*, J. W. Welch*.

Wisconsin

BOGUSZ, WALTER, Asst. Dir., Htg. Equipment Lab., A. O. Smith Corp., Milwaukee. REFERENCES: Alexander Galaba, C. F. Hoffman, H. W. Snyder, J. W. Tracy*.

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OBITUARIES

JAMES J. FRASER
Middlesex, England

The Society has been advised of the passing on July 17 of one of its members, James J. Fraser, managing director, Honeywell-Brown, Ltd., Perivale, Greenford and Middlesex, England. Mr. Fraser joined the Society in 1936 as an associate member.

Born on September 9, 1901 in Grantown, Scotland, Mr. Frazer attended the North British Electrical College and Glasgow Royal Technical College. His first position was with the Marconi Co., London, where he remained from 1922-24. Between 1924-26 he was associated with the African & Eastern Trade Corp., Nigeria, West Africa, as a supervisor. He was also a sales engineer and sales manager for engineering companies in Canada. Mr. Frazer joined the Minneapolis-Honeywell Regulator Co., Minneapolis Minn., in 1929 and since that date had been associated with that firm both in the United States and Canada. He went to England in 1936 to originate and manage the British branch of the company. Although his base of operations was in England, Mr. Frazer

OBITUARIES *(continued)*

spent sometime in America for his company.

The Officers and Council of the Society extend their deep sympathy to his family.

PHILLIP E. MEIDENBAUER, JR. Lancaster, N.Y.

Members of the engineering profession and aircraft industry together with the armed forces were greatly saddened to learn of the passing on July 6, 1953, of Phillip E. Meidenbauer, Jr., partner, The Firewel Co., Inc., Buffalo, N.Y. A member of the Society since 1947, Mr. Meidenbauer was considered one of the nation's outstanding authorities on aircraft ventilation, heating and oxygen equipment. He recently achieved world-wide recognition for his company's contribution in providing all the mechanical controls for the *world's first space suit* developed by the Navy.

A self-made man, Mr. Meidenbauer was born on December 14, 1913 in Lancaster, N.Y. where he attended Lancaster High School. From 1936-40 he was associated with the Hydro Blast Corp., Chicago, Ill., as assistant to the engineer in charge of building a process plant. He joined the Scott Aviation Corp., Lancaster, N.Y., as director of research in 1940, remaining with that corporation until 1946. In that same year he started his own business, the Firewel Co., and was responsible for all engineering and sales activities concerning the manufacture of gas-fired furnaces. With great foresight, Mr. Meidenbauer decided to expand the business by manufacturing special oxygen handling equipment for both the Army and the Navy. All airplanes now flying at 55,000 ft are equipped with oxygen apparatus of his design.

At the time of his death, Mr. Meidenbauer was one of the *top* advisors to the government in aircraft and associated lines. He also held more than 50 patents on various breathing, ventilating and oxygen apparatus. Most of Mr. Meidenbauer's work for the government was so secretive that details concerning it will not be released for years to come.

Mr. Meidenbauer was also a member of the *Institute of Aeronautical Sciences*, the Rotary and the Aero Club of Buffalo.

The Officers and Council of the Society extend their profound sympathy to members of his family.

LOUIS A. WELCH, JR. Schenectady, N.Y.

News has been received of the death of Louis A. Welch, Jr. on June 5, 1953. Retired since 1950, Mr. Welch was elected to a Life Membership in the Society in that same year.

Born on May 11, 1880, in Lee County, Ill., he came to Schenectady, N.Y., in 1892. He started his own heating and plumbing business,

Louis A. Welch, Jr.
Schnectady, N. Y.

Welch Brothers, in 1910 and had about 50 years of experience in installing and designing heating systems. Upon his retirement in 1950 his son, Robert A. Welch, became the active head of the business.

Mr. Welch was a member of the Masons, I.O.O.F. Lodge, Y.M.C.A., *Master Plumber's Association*, Schenectady Rotary Club and Mohawk Golf Club. He helped to organize both the Chamber of Commerce and the Community Chest and became president of the latter. Mr. Welch also served as a board member of the Red Cross and the Boy Scouts.

The Officers and Council of the Society extend their sympathy to his family.

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● ILLINOIS: 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, H. G. Chapin, 185 N. Wabash Ave., (1). SECRETARY, H. G. Gragg, Rm. 1310, 228 N. LaSalle St. (1).

● INDIANA: 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, R. C. Blackman, 5505 N. Illinois St. (8). SECRETARY, J. W. Jackson, 3514 N. Drexel, (18).

● INLAND EMPIRE: 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, G. M. Dieter, 917 W. Mallon. SECRETARY, F. W. Jenkinson, N. 1904 Smith St., (15).

● IOWA: 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, J. F. Sandfort, Iowa State College, Ames. SECRETARY, G. J. Kraai, 907 Sixth Ave. (14).

● KANSAS: 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, R. L. Pennington, 520 So. Commerce (2). SECRETARY, O. B. Strahm, 601 So. Terrace Dr.

● KANSAS CITY: 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, G. H. Stoffer, 200 Riss Building (6). SECRETARY, A. S. Hurt, Jr., 2119 Washington St., (8).

● MANITOBA: 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, A. K. Piercy, 222 Osborne St. N. SECRETARY,, D. B. Brace, 1550 Dublin Ave.

● MASSACHUSETTS: 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, A. L. Hare, 127 Federal St. (10). SECRETARY, W. G. Martin, Jr., 20 Winchester St. (16).

● MEMPHIS: 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● MIAMI VALLEY: 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, Dayton (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● MICHIGAN: 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, R. H. Oberschulte, 316 McKerchey Building, (1). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● MINNESOTA: 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, V. E. Pearson, 739 Marquette Ave. (2). SECRETARY, E. T. Erickson, 500 Baker Arcade.

● MISSISSIPPI: 1953. Hdqrs., Jackson, Miss. PRESIDENT, Burt Lomax, Jr., P. O. Box 1662. SECRETARY, J. G. Coleman, 2840 Arbor Hills Drive.

● MONTREAL: 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, B. J. Horsburgh, 940 Ogilvy Ave. (15). SECRETARY, R. J. Ker, 1000 Beaver Hall Hill, P. O. Box 340.

● NEBRASKA: 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 608 City Hall (2).

● NEW YORK: 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, J. E. Schechter, 28 Brower Ave., Woodmere, L. I. SECRETARY, Carl H. Flink, 62 Worth St. (13).

● NORTH JERSEY: 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● NORTH TEXAS: 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● NORTHEASTERN OKLAHOMA: 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● NORTHERN OHIO: 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● NORTHERN PIEDMONT: 1952. Hdqrs., Greensboro, N.C. Meets, Second or Third Friday. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● OKLAHOMA: 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. I. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● ONTARIO: 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, N. W. Kingsland, 31 Willcocks St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● OREGON: 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● OTTAWA VALLEY: 1952. Hdqrs., Ottawa, Ont., Canada. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● PACIFIC NORTHWEST: 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, 20031 Marine View Dr. S.W. (66).

● PHILADELPHIA: 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, C. F. Dietz, 3449 W. Indiana Ave. (32). SECRETARY, P. H. Yeomans, Architects Building (3).

● PITTSBURGH: 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● ROCKY MOUNTAIN: 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, H. L. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● SACRAMENTO VALLEY: 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, E. C. McKinsey, 4220 Annette (21). SECRETARY, R. A. Sarro, 5412 Argo Way.

● ST. LOUIS: 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, H. C. Sharp, 4060 W. Pine Blvd. (8). SECRETARY, W. P. Norris, 1118 Fullerton Bldg.

● SHREVEPORT: 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, M. A. Hudson, 753 Gladstone Blvd. SECRETARY, R. S. Segall, 603 Cotton St.

● SOUTH TEXAS: 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, E. G. Floeter, Jr., P.O. Box 6006 (6). SECRETARY, F. M. Neil, 3513 W. Dallas Ave. (19).

● SOUTHERN CALIFORNIA: 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, L. B. Davenport, 137 S. Anderson St. (33). SECRETARY, J. L. McCullough, 1978 S. Los Angeles St. (11).

● SOUTHERN PIEDMONT: 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● SOUTHWEST TEXAS: 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● UTAH: 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, M. L. Gollaher, 1163 Roosevelt Ave. (5). SECRETARY, G. L. Soderborg, Sr., 42 E. 8th St. S.

● VIRGINIA: 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● WASHINGTON, D. C. 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, J. G. Muirheid, Bureau of Ships, Navy Dept. (25). SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N. W. (6).

● WESTERN MICHIGAN: 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. T. Anderson, Michigan State College, East Lansing. SECRETARY, R. J. Waalkes, Michigan State College, East Lansing.

● WESTERN NEW YORK: 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, C. W. Stone, 503 Franklin St. (2). SECRETARY, C. W. Kaupp, 271 Delaware Ave.

● WISCONSIN: 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, N. E. Hill, 122 N. Hartwell Ave., Waukesha. SECRETARY, K. H. Forfar, 2711 N. 27th St. (10).

SPECIAL BRANCH

● SWISS: 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● NORTH CAROLINA STATE COLLEGE: 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, S-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● OKLAHOMA A. & M. COLLEGE: 1950. Hdqrs., Stillwater, Okla. Address mail to: Prof. R. R. Irwin, Dept. of M. E., Oklahoma A. & M. College.

● OREGON STATE COLLEGE: 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletsel, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● PURDUE UNIVERSITY: 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● TEXAS A. & M. COLLEGE: 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, C. E. Beavers, Box 4083. SECRETARY, C. R. Blank, Jr., Box 2021.

● UNIVERSITY OF DETROIT: 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

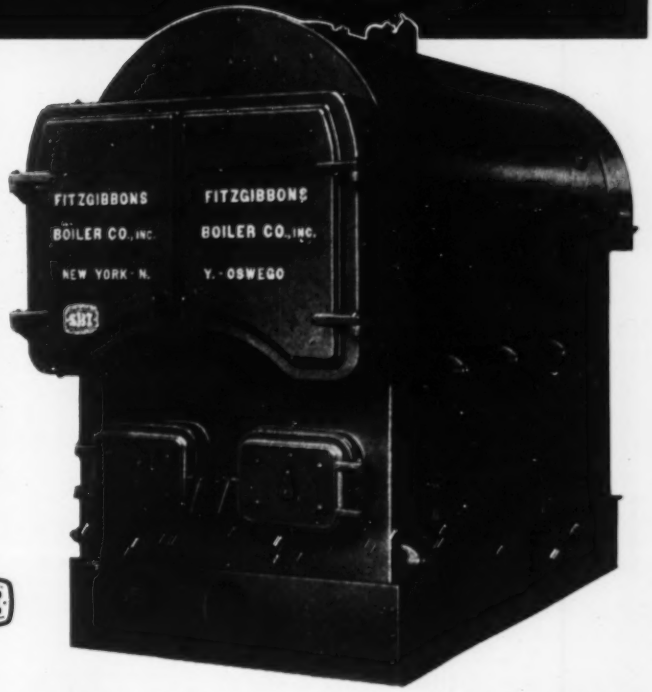
● UNIVERSITY OF KANSAS: 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● UNIVERSITY OF TEXAS: 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● UNIVERSITY OF TORONTO: 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.

FITZGIBBONS "D" TYPE STEEL BOILERS

now serving thousands of large buildings everywhere, have long passed the need for proof of their unsurpassed performance and fuel economy. Apartment owners, office building operators, management staffs of schools, churches, institutional buildings and large department stores of national fame—all acclaim it. The Fitzgibbons "D" Type boiler meets or exceeds ASME Code requirements in all details of construction, as certified by a resident Hartford inspector and is S.B.I. rated. Sixteen sizes from 3,650 to 42,500 sq. ft., steam.



The "D" Type Catalog gives all facts and data. On request from the Fitzgibbons Boiler Company, Inc., 101 Park Avenue, New York 17, N. Y., Dept. HP-9

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If water is a problem,
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UNICON by Kramer,
the air-cooled condenser that DOES NOT USE WATER!

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Stands, hoods, and wind deflectors are available for simplified mounting. You need nothing else!

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Old timers will recall the day—more than 20 years ago—when Taylor Forge announced the first comprehensive line of butt-welding fittings.

Before the WeldELL line was introduced, the only available welding fittings were elbows. But in the WeldELL line came all the fittings needed to do a complete and workmanlike job of pipe welding . . . the tees, reducers, caps, stub ends, and welding flanges.

To produce all of these types of fittings in seamless forged steel was a giant undertaking—and still is. A good example of this is the line of reducers. Today there are 175 reductions in standard weight reducers alone—and this can be multiplied by all the weights and materials in which Taylor Forge reducers are available.

The first line is still the foremost line—the engineered line, the full value line. For up-to-the-minute facts about the WeldELL line, see your Taylor Forge Distributor.

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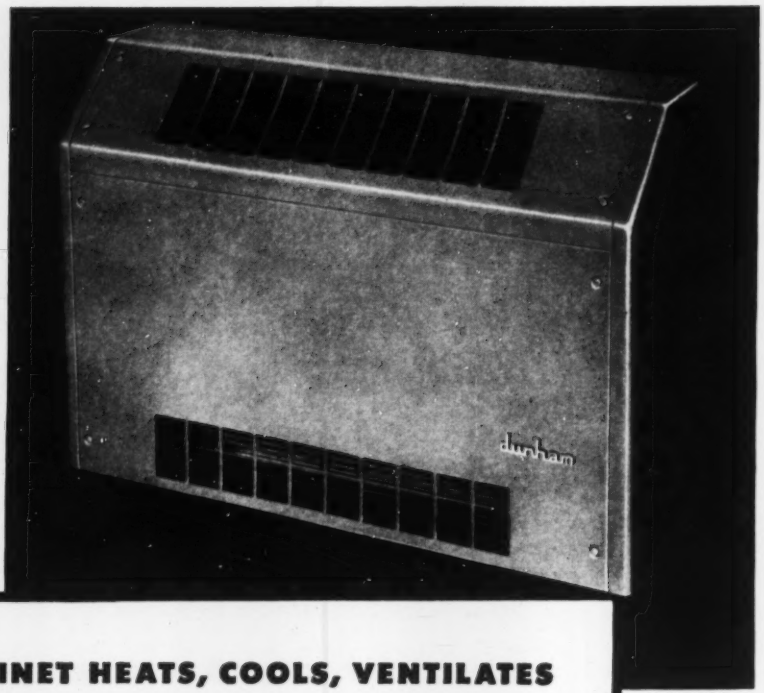
"Easy to mount on floor, wall or ceiling"

"Uses hot and cold running water"



NEW DUNHAM CABINET HEATS, COOLS, VENTILATES TO SUIT INDIVIDUAL ROOM REQUIREMENTS

New Dunham "Vari-Temp" Cabinets now put year 'round air conditioned comfort within reach of every budget . . . and within easy reach of every room occupant. For "Vari-Temp," with twin blower fans, heats, cools, ventilates, filters and dehumidifies *on an individual room basis.*

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In addition, these handsome, compact cabinets save space. *One "Vari-Temp"* delivers the same amount of heat as *five radiators* equal to it in size!

For further information about space-saving, money-saving, room-controlled Dunham "Vari-Temp" Cabinets . . . clip and mail the coupon.

DUNHAM **VARI-TEMP CABINETS**

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One of many comprehensive Ladish laboratory test procedures for assuring reliable performance.

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Metallurgical integrity—is safeguarded at Ladish by unsurpassed laboratory controls. Typical is this advanced electronic direct-reading spectrograph. On this unit as many as 300 determinations have been made in one hour to verify compliance of each mill heat with exacting Ladish specifications and, equally important, to assure the absence of detrimental "tramp" elements. Here is but one indication of the thorough, scientific procedures that assure reliability in every Ladish Controlled Quality fitting.

THE COMPLETE *Controlled Quality* FITTINGS LINE
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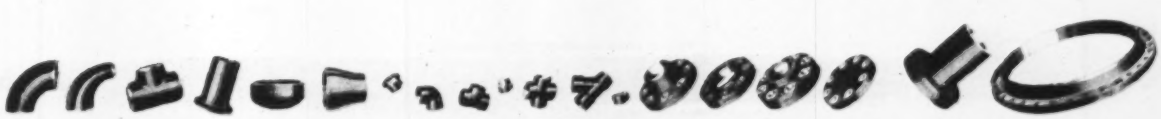

YOU SELECT *the Deaerating Heater you need.....*

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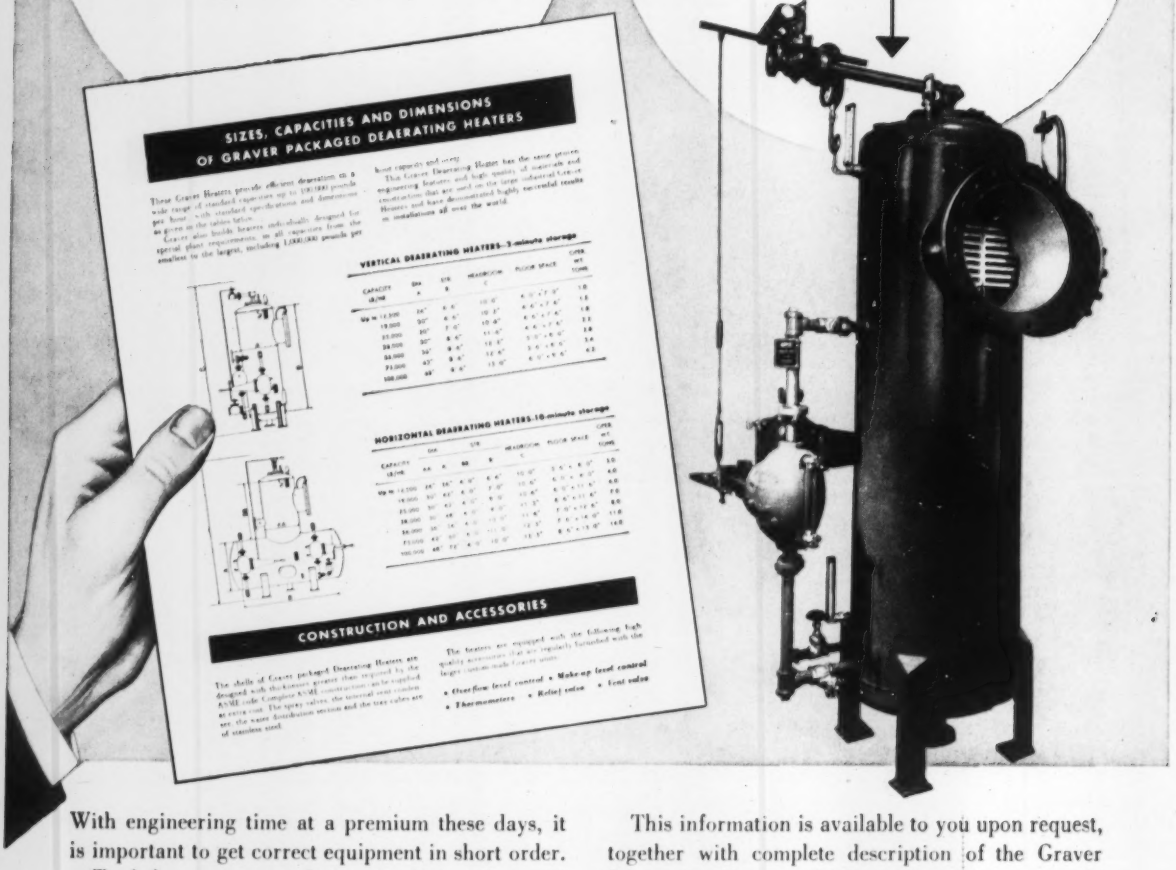
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OF GRAVER PACKAGED DEAERATING HEATERS
VERTICAL DEAERATING HEATERS—3-minute storage
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CONSTRUCTION AND ACCESSORIES

With engineering time at a premium these days, it is important to get correct equipment in short order.

To help you get a *deaerating heater* that will exactly meet your needs, Graver has developed charts and data sheets that give complete engineering, selection and dimensional information for a wide range of heater capacities.

This information is available to you upon request, together with complete description of the Graver Deaerating Heaters which are furnished as a package . . . with all internal parts, controls, valves and instruments you need for the installation. Your request for this information will not involve the slightest obligation on your part.

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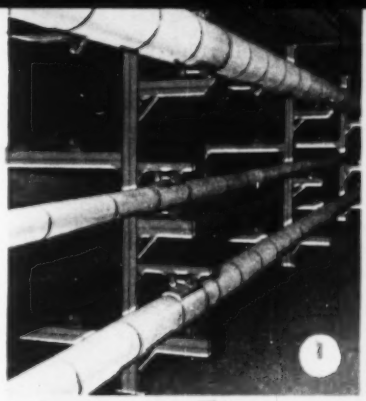
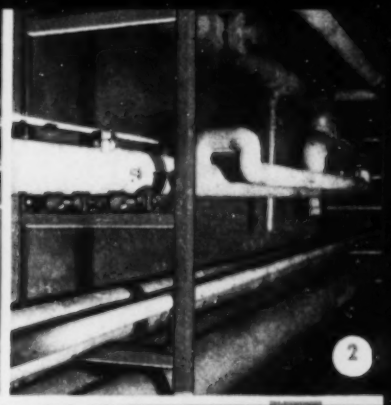
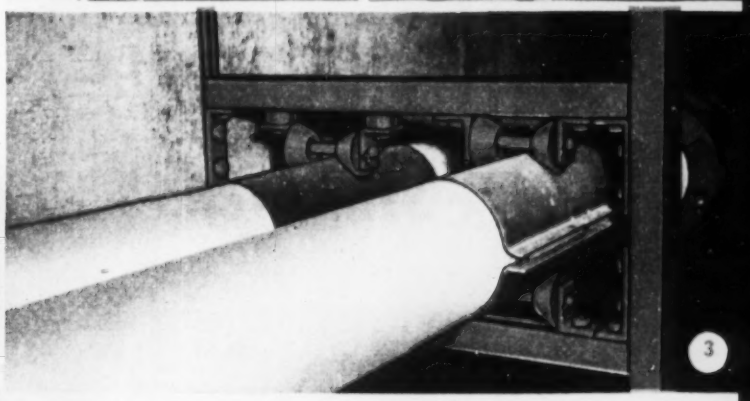
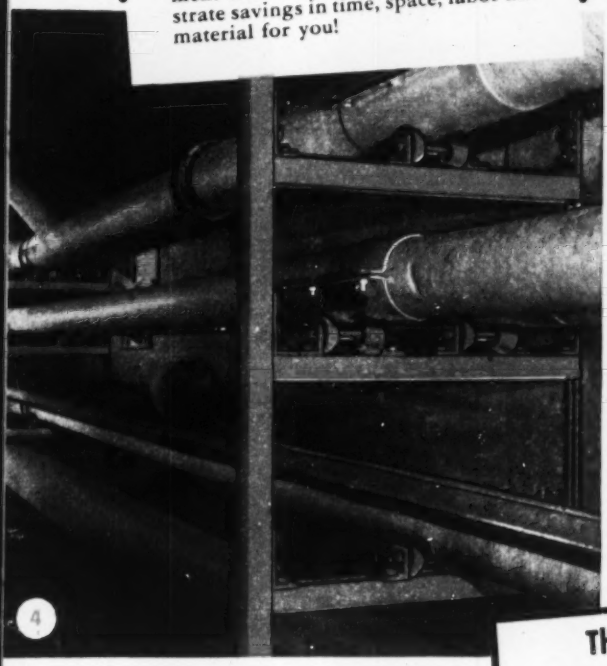
METAL FRAMING

All-purpose construction material assures exact slope or pitch, permits changes or additions at any time. Easy to erect—no special tools or equipment needed. Let UNISTRUT demonstrate savings in time, space, labor and material for you!

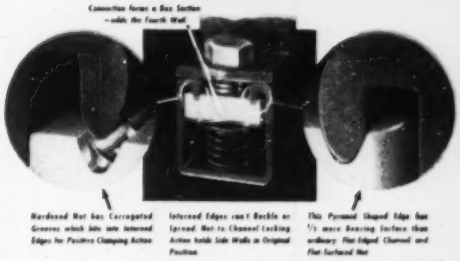








Only the UNISTRUT Framing System has this Positive Clamping Action at all Points of Connection!


Connection forms a Box Section —adds the Fourth Wall
Hardened Nut has Corrugated Grooves which bite into Inturned Edges for Positive Clamping Action
Inturned Edges can't Buckle or Spread Nut to Channel Locking Action holds Side Walls in Original Position
This Pyramid Shaped Edge has 1½ more Bearing Surface than ordinary Flat-Edged Channel and Flat Surfaced Nut

1 Note how UNISTRUT framework's great strength easily supports long runs of heavy piping, including bulky 16" chilled water lines.

2 Typical piping installation supported by UNISTRUT framing, concrete inserts and roller pipe supports. Slotted channel permits attachment of fittings at any desired point.

3 Steamline showing method of supporting pipe at expansion joints. Note pipes are supported above and below with UNISTRUT pipe rollers.

4 Tunnel job showing how UNISTRUT continuous run concrete inserts can be installed vertically or horizontally, or at any angle required.

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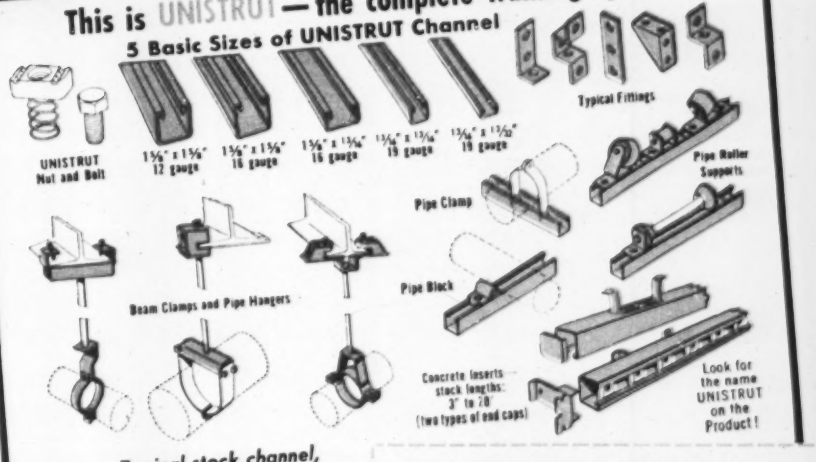
See our Catalog in Sweet's 1953 Plant Engineering, Industrial Construction and Architectural Files.

U. S. Patent Numbers

2327587	2329815	2345650
2363382	2380379	2405631
2541908	Other Patents Pending	

This is UNISTRUT—the complete framing system

5 Basic Sizes of UNISTRUT Channel


UNISTRUT Nut and Bolt
1⅝" x 1⅝" 12 gauge
1⅝" x 1⅝" 16 gauge
1⅝" x 1⅝" 16 gauge
1⅝" x 1⅝" 19 gauge
1⅝" x 1⅝" 19 gauge
Typical Fittings
Pipe Roller Supports
Pipe Clamp
Pipe Block
Beam Clamps and Pipe Hangers
Concrete Inserts stock lengths: 3" to 20' (two types of end caps)
Look for the name UNISTRUT on the Product!

Typical stock channel, parts and fittings.

Write for NEW Free 84-page Pocket Catalog No. 800!

For the Man on the Job—packed with photos, drawings, ideas and data on how to frame, mount, rack and support electrical and mechanical equipment with UNISTRUT metal framing.

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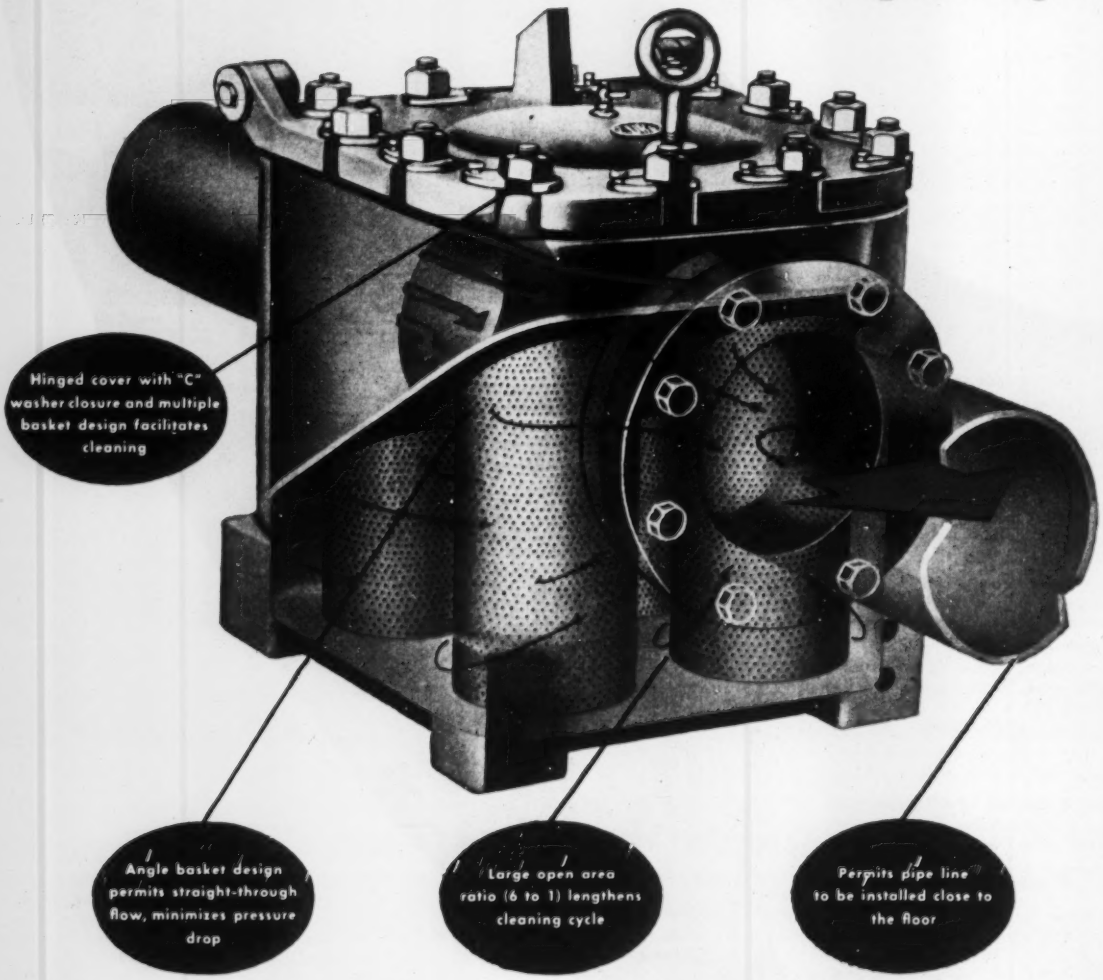
The World's Most Flexible All-Purpose Metal Framing

LONGER INTERVALS

ZURN **SINLEX MULTIPLE BASKET**

Zurn LPD Strainers permit high rates of flow with remarkably low pressure drop. They provide continuous flow of liquids, immeasurably improving the handling of fluids such as oil, chemicals, water, through pipe lines. They provide the utmost protection from costly shut downs.

L-P-D- STRAINERS *permit one-man operation— reduce operating cost*


Hinged cover with "C" washer closure and multiple basket design facilitates cleaning
Angle basket design permits straight-through flow, minimizes pressure drop
Large open area ratio (6 to 1) lengthens cleaning cycle
Permits pipe line to be installed close to the floor

BETWEEN BASKET CLEANING

provided by large open area ratio of

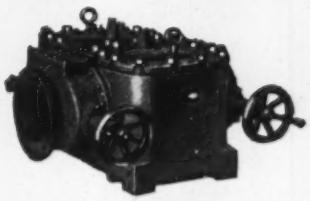
ZURN *SINLEX MULTIPLE BASKET*

Low Pressure Drop STRAINERS

The angle basket design of this strainer is typical of how Zurn Low Pressure Drop (LPD) Strainers have been design improved for correct circularity. This angle type Multiple Basket Strainer permits straight-through flow, minimizing the pressure drop and insures complete retention of strained particles when basket is being removed for cleaning. A feature of this strainer is the small space required for its installation. It permits pipe line to be installed close to the floor. It has ample waterways, smooth inner walls, correctly sized and perforated baskets, and affords maximum protection for all types of mechanical units connected with pipe lines. Zurn LPD Strainers are held to close tolerances for materials, shapes, and dimensions, assuring the utmost in strength and factors of greater safety essential to continuous operation.

Zurn LPD Strainers are widely used to protect close tolerance control devices and delicate mechanisms, also to protect product purity. Their large open area ratio (6 to 1) lengthens intervals between need for cleaning baskets. Zurn Fluid Handling Engineers are available for consultation on your particular fluid handling problem.

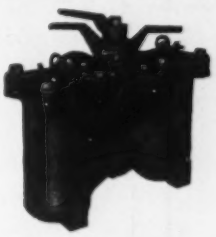
There is a ZURN LPD Strainer for every fluid handling purpose



Zurn LPD Duplex Multiple Basket Strainer, Gate-Type.

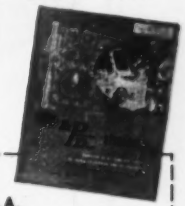
Zurn LPD "Y" Type Strainer, available in any cast material and for high pressures.

Zurn LPD Sinlex Strainer, available in offset and straight-through types.



Zurn LPD Duplex Multiple Basket Strainer, Plug-Type.

Zurn LPD Strainer applications include fluid handling lines for lubricating and fuel oil, and oil during the refining process; a wide range of chemicals produced and used by the various process industries; public utility power plants; power stations; industrial plants; ships and high temperature installations. Zurn Fluid Handling Engineers are available for consultation.



WRITE FOR ZURN LPD STRAINER DATA MANUAL NO. 952 →

This Manual includes previously unpublished pressure drop data and gives useful, factual information on fluid handling.

Zurn Engineered Low Pressure Drop Strainers are patented and patents pending. Copyright 1953.

J. A. ZURN MFG. CO.

INDUSTRIAL DIVISION • ERIE, PA., U. S. A.

In Canada: Canadian Zurn Engineering Ltd., Montreal, 25, P. Q.

J. A. ZURN MFG. CO.
Industrial Division, Erie, Pa., U.S.A.

Please send me Zurn LPD Strainer Data Manual No. 952.

Name .....

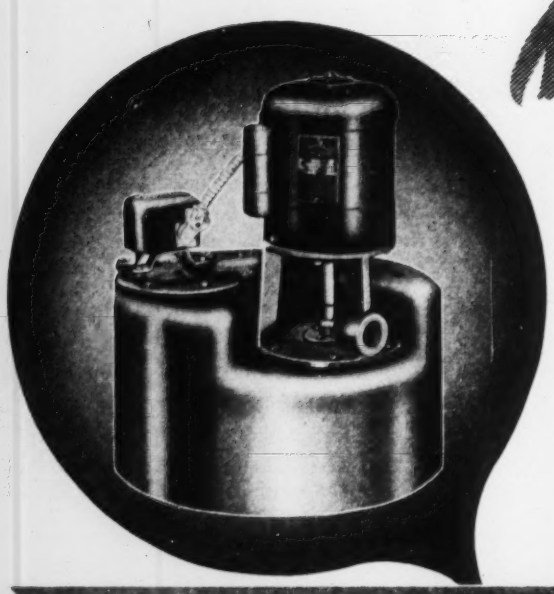
Position .....

Company .....

Street .....

City and State .....

Please attach coupon to your business letterhead. Dept. HPAC.



Now Ready!

- **The New Skidmore Duplex Unit offers increased heating pump efficiency. Compact and self-contained — the "CV" Duplex Unit has all the outstanding features of the Skidmore "CV" Single Unit plus extra heavy-duty performance when conditions warrant.**

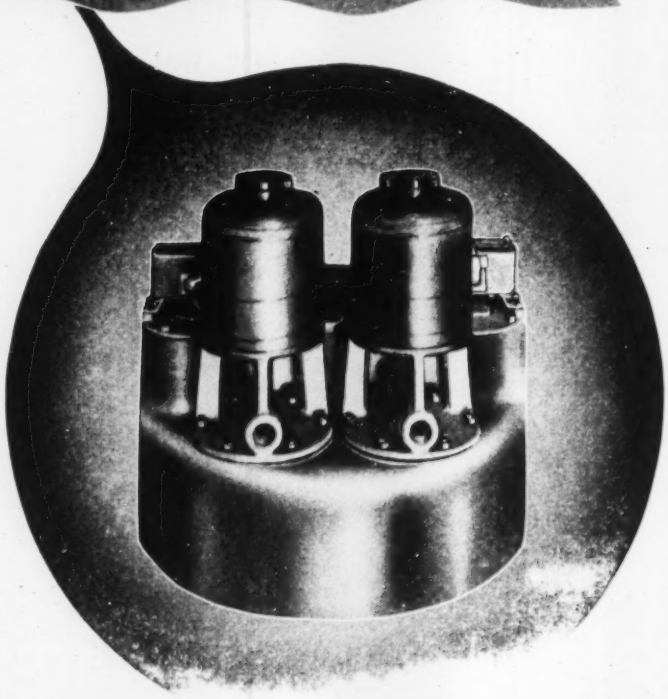
LEFT — SINGLE UNIT

BELOW — DUPLEX UNIT

The NEW "CV" Duplex Unit!

The New Skidmore Duplex Unit is furnished with individual float switches, so each pump may be controlled independently or with automatic alternating switch, which affords a positive means of alternating the operation of the two pumps in turn insuring even wear. The second pump automatically starting into operation when one pump cannot handle the load under peak conditions. Pump is completely assembled ready for return and discharge connections — can be installed on floor level or in pit — float switch is on top for convenient operation.

NOW READY—New Bulletin No. 21-A gives complete engineering data on both the Vertical "CV" Single and Duplex Units.



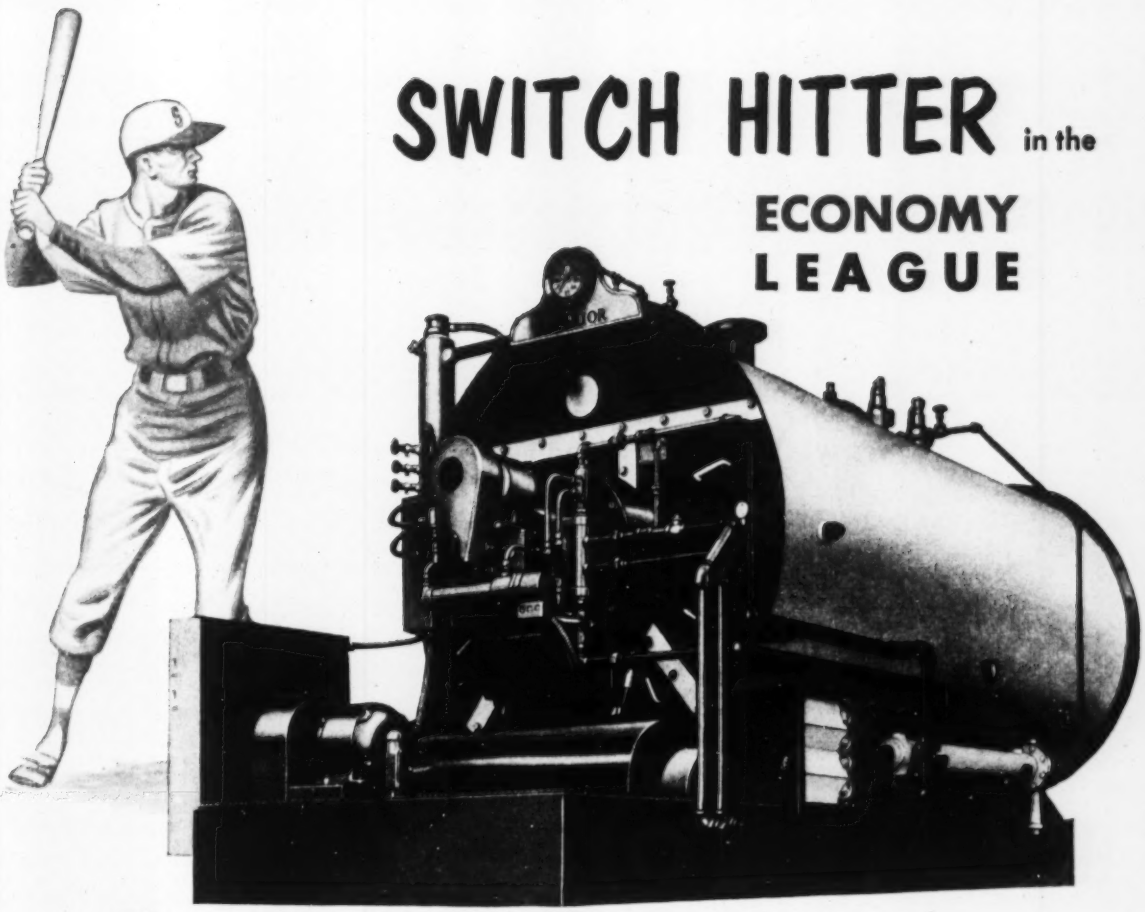
The Duplex Unit above, has two separate float switches to control each pump independently.

Skidmore builds a type for every installation.

Write for bulletins on other heating pumps.

SKIDMORE CORPORATION ● ST. JOSEPH, MICHIGAN

SWITCH HITTER in the ECONOMY LEAGUE



SUPERIOR
STEAM GENERATORS

Just as the switch hitter changes his batting stance to take full advantage of the pitching situation, Superior Steam Generators change fuels to take advantage of the price situation. When equipped with combination gas/oil burners, Superior Steam Generators switch from one fuel to the other quickly, and without dismantling the equipment or interrupting the steam supply.

Superior Steam Generators are completely factory-assembled and fully tested prior to shipment for guaranteed performance exceeding 80% thermal efficiency, fully automatic . . . burning oil or gas . . . and are available in 18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for catalog 504-F.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

New Modular MULTI-VENT® concealed ceiling panels

COSTS LESS TO INSTALL

than ordinary air diffusers!

Yes! That is the big news in commercial, institutional, and industrial air conditioning for 1953.

Now you can install this superior low velocity pressure displacement type of air distribution for metal pan ceilings at a far *lower* cost than the high velocity injection type.

This is possible because the new MODULAR PANELS are so extremely simple and easily positioned. They can be assembled and installed in a few seconds by hand without the use of tools —a tremendous saving in labor cost!

Distributing air by Multi-Vent's gentle pressure displacement assures perfectly even air motion, and exceptional uniformity and control of room temperatures. The total absence of strong air streams or blow eliminates all the usual sources of draft complaints and permits complete freedom in locating panels and in relocating partitions.

Write today for detailed literature.

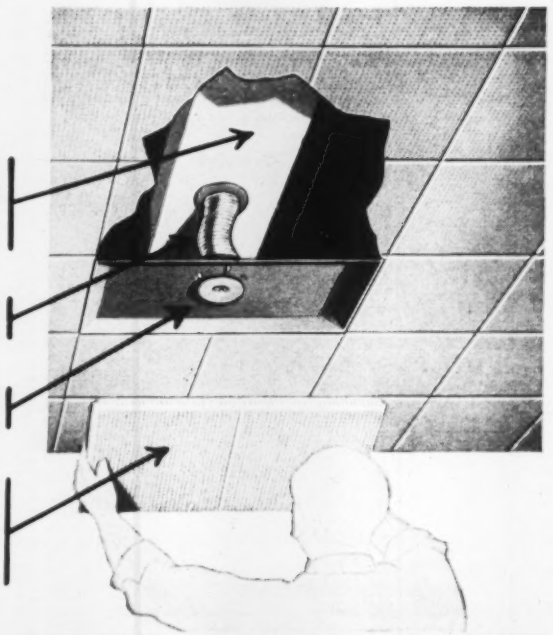
LABOR SAVING INSTALLATION FEATURES

■ **ADAPTABLE** . . . Duct can be shop built with 3-inch diameter openings at approximate panel locations. Duct work can be installed, flexible tubes with valve snapped in, and system balanced prior to and independent of ceiling erection. Panels can be located without regard to position of lighting fixtures and partitions.

■ **FLEXIBLE** . . . compressible tubing permits wide latitude in alignment, thus radically reduces installation cost by eliminating all need for time consuming close fitting sheet metal work.

■ **ADJUSTABLE** . . . orifice valve can be simply set by wing nut for varied amount of air delivery. Individual panel adjustments do not disturb the overall balance of the system.

■ **COMPLETELY CONCEALED** . . . ANY STANDARD PERFORATED 12" x 24" ACOUSTICAL METAL CEILING PAN (supplied by the ceiling contractor) functions as the distribution plate for the MODULAR MULTI-VENT PANEL. The panel simply replaces the acoustical pad and nests snugly in the pan which snaps into ceiling tee runner, unhampered. Ceiling face is undisturbed.



MULTI-VENT DIVISION **THE PYLE-NATIONAL COMPANY**

Sales and Engineering Representatives in Principal Cities of United States and Canada

1373 North Kostner Ave. Chicago 51, Illinois

For complete TUBE TURNS' service
CALL YOUR DISTRIBUTOR

Through your TUBE TURNS' Distributor you can get fast, local service and the right TUBE-TURN Welding Fitting and Flange for every piping need. There are more than 4,000 types and sizes in carbon steels, stainless steels, chrome-moly steels, copper, aluminum, brass, Monel metal, Inconel, nickel, wrought iron. Call him for this *complete, fast* service.

The mark of the Thoroughbred

Identification of genuine TUBE-TURN Welding Fittings is positive and permanent. Spot welded in place, this embossed steel tag shows Tube Turns' trade marks, size and wall thickness, ASTM specification, and weight. In addition, a laboratory control number is rolled into each fitting.

TUBE-TURN SEAMLESS WELDING FITTINGS • RANGE OF TYPES AND SIZES

TYPE OF FITTING (ALL DIMENSIONS IN INCHES)		CARBON STEEL						
		STANDARD WALL	EXTRA STRONG WALL	SCHEDULE 160	DOUBLE EXTRA STRONG WALL	SPECIAL SCHEDULES	LIGHT GAGE NOM. O. D.	LIGHT GAGE I. P. S. O. D.
ELBOWS	90° Long Radius	½-36	½-36	1-12	¾-8	8-24	4-24	¾-12
	90° with Tangent	1½-12	1½-12					
	90° Reducing	2x1-6x3	2x1-6x3					
	90° Short Radius	1-30	1½-30			8-24		
	45° Long Radius	½-36	½-36	1-12	¾-8	8-24	4-24	¾-12
RETURNS	180° Long Radius	½-36	½-36	1-12	2-8	8-24	4-24	¾-12
	180° Ex. Long Rad.	1-2½	1-2½					
	180° Short Radius	1-30	1½-30			8-24		
TEES	Straight Outlet	½-30	½-30	½-12	½-8			
	Reducing Outlet	½-30	½-30	½-12	½-8			
REDUCERS	Concentric	¾ x ⅜ 24 x 16	¾ x ⅜ 24 x 16	¾ x ⅜ 12 x 5	¾ x ½ 8 x 3½			
	Eccentric	¾ x ⅜ 24 x 16	¾ x ⅜ 24 x 16	¾ x ⅜ 12 x 5	¾ x ½ 8 x 3½			
CAPS		¾-24	¾-24	1-12	1-8			
STUB ENDS	Lap Joint	½-24	½-24					
LATERALS	Straight Outlet	1-24	1-24					
	Reducing Outlet	1-24	1-24					
CROSSES	Straight Outlet	1¼-24	1¼-24					
	Reducing Outlet	1¼-24	1¼-24					
RINGS	Groove Type	¾-24	1-24		1¼-8			
	Ridge Type	¾-12	¾-12					
SADDLES[1]		2-24						
SLEEVES[1]		2-24						

[1] Since SADDLES and SLEEVES are used for external reinforcement only, they do not conform to Iron Pipe Size Thickness.

TUBE-TURN FORGED STEEL FLANGES • RANGE OF TYPES AND SIZES

TYPE OF FLANGE (ALL DIMENSIONS IN INCHES)		CARBON STEEL						
		150 LB	300 LB	400 LB[1]	600 LB	900 LB[2]	1500 LB	2500 LB
WELDING NECK		½-24	½-24	½-24	½-24	½-24	½-24	½-12
SLIP-ON		½-24	½-24	½-24	½-24	½-24	½-24	½-12
LAP JOINT		½-24	½-24	½-24	½-24	½-24	½-24	½-12
THREADED		½-24	½-24	½-24	½-24	½-24	½-12	½-12
BLIND		½-24	½-24	½-24	½-24	½-24	½-24	½-12
SOCKET TYPE		¼-24	¼-4		¼-3½			
REDUCING	Threaded or Slip-On	¾-24	¾-24	¾-24	¾-24	¾-24	¾-12	¾-12
ORIFICE	Threaded		1-24	4-12	1-12	3-12	1-12	
	Slip-On		1-24					
	Welding Neck		1-24	4-12	1-12	3-12	1-12	

[1] Dimensions on sizes thru 3½ inch (except Orifice Flanges) same as for 600 lb. flanges.
[2] Dimensions on sizes thru 2½ inch (except Orifice Flanges) same as for 1500 lb. flanges.

Larger size fittings and flanges available. Specifications on request.

"tt" and "Tube-Turn" Reg. U. S. Pat. Off.

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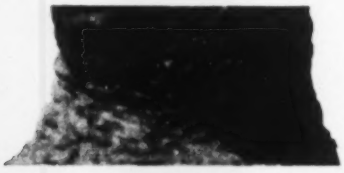
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles • Denver • Atlanta

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO • PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA.

"Built-in" endurance Only an elephant can do an elephant's job. For a giant's job in steel pipe, specifications experts know, when they specify Wheatland, that nothing has been overlooked in processing to insure a giant's strength, a giant's endurance—built right into the steel to stay.

WHEATLAND TUBE CO

BANKERS SECURITIES BUILDING, PHILADELPHIA 7, PA.

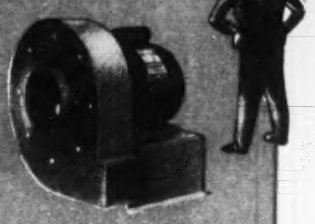


Peerless BLOWERS

STANDARD OR CUSTOM *Engineered to your requirements*

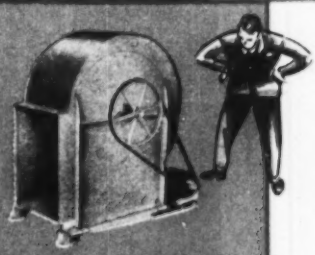
DIRECT DRIVE

General ventilation and exhaust type for use in boiler rooms, restaurants, washrooms, etc. Motors available for all types of current. Housings constructed of 16-gauge steel.



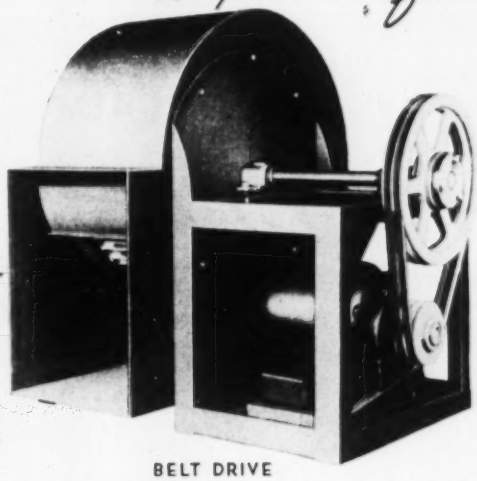
PRESSURE BLOWER

For exhaust removal of dust or grit, high-pressure conveying, cooling, etc. Blades are dynamically balanced and self-cleaning. Ball-bearing motors. Base and housing of heavy-gauge steel.



ARR. 3-UTILITY BLOWER

Clock or counterclockwise rotation. Blower is easily adapted to ventilation and exhaust systems. Single or double width. Motors and drives available. Vibration bases optional.



BELT DRIVE

V-belt with motor pulley adjustable for variety of speeds. Arc welded housings and frames. Clockwise rotation. Bottom horizontal discharge.

Peerless builds a standard line of blowers suited to economical use and installation. Standard features:

ARC WELDED FRAMES AND HOUSINGS.

DYNAMICALLY BALANCED BLOWER.

DUAL GRIP ADJUSTABLE BELT.

CONVERTIBLE DISCHARGE. and

CUSTOM-BUILT PEERLESS MOTOR are easily adapted to most circumstances. When the installation you plan requires special equipment, Peerless designers and engineers will work with you to achieve the result you want. If needs be, Peerless will fly an engineer to your doorstep.

Peerless techniques are flexible. Engineers and designers cooperate with the Peerless Motor Division to create properly matched blowers and motors. They design and build blowers for electronic cooling, conveying, air conditioning, and dust and odor control.

Bring your blower problems to Peerless where they'll be solved quickly, efficiently and economically by men who have 60 years of blower experience on which to draw.

"SMOOTHEST PERFORMERS ON THE MARKET"

Peerless Electric

THE PEERLESS ELECTRIC COMPANY
FAN AND BLOWER DIVISION
1409 WEST MARKET ST. . WARREN, OHIO

THE PEERLESS ELECTRIC COMPANY
1409 WEST MARKET ST WARREN, OHIO

Please send me Bulletin SDA-160 listing Peerless Fans and Blowers Data.

Name_____

Company_____

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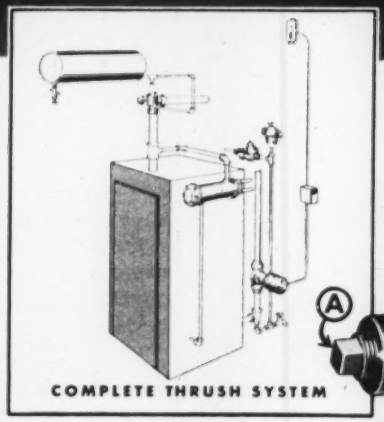
it's NEW!

THRUSH Tank Drain

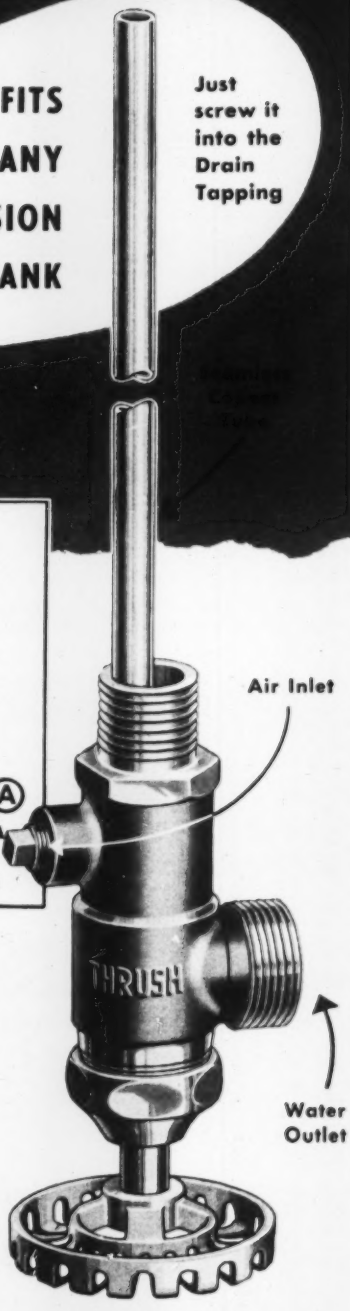
Reduces DRAINING TIME

FITS ANY EXPANSION TANK

Just screw it into the Drain Tapping



COMPLETE THRUSH SYSTEM



- A simple, inexpensive valve combining air tube and drain.
- Fits drain tapping . . . easily installed . . . inexpensive. Two tube lengths.
- Eliminates guesswork, saves time. A few minutes drains the average size tank.
- Pleases home owner, pays for itself on the first draining.

A REAL CONVENIENCE

and profit maker too!

DRAINING waterlogged pressure tanks is simple, quick and positive if you'll install a Thrush Tank Drain. While all genuine Thrush Pressure Tanks now come equipped with the Thrush Vacuum Breaker, there are many older installations where the tank has only one drain tapping. Now you can enjoy the same convenience in tank draining on these older jobs, too. The Thrush Tank Drain combines Vacuum Breaker and Drain Valve in one inexpensive fitting. When the tank needs draining, simply open drain, remove plug "A" to break the vacuum and tank will drain completely. It is a profit item you can sell all year through. For more information, see your wholesaler or write Department E-9.

THRUSH COMPANY • Perry, Indiana

Here are 3 good ideas for you

Consider them in the light of helpful suggestions—each representing an advantage in a distinctive type of tube fabrication that could mean:

A DECREASE IN PRODUCTION COSTS

A REDUCTION IN MAINTENANCE COSTS

AN IMPROVEMENT IN YOUR PRODUCT

AN INCREASE IN OPERATING EFFICIENCY

FABRICATED TUBULAR PARTS

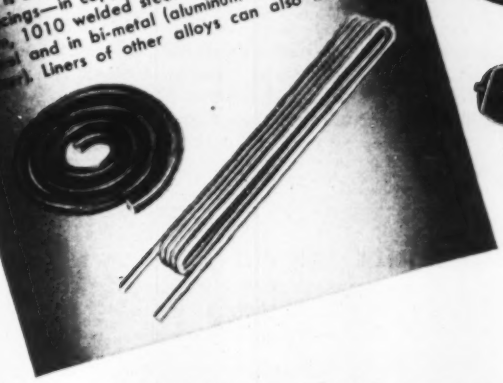
Many tubular parts, surprisingly enough, can often be produced more economically by using an existing tubular form to begin with and carrying on from that point. Wolverine facilities are ready to serve you in these operations: bending, splaying, expanding, coiling, finning, beading, flaring, soldering, threading, cutting, annealing, and other related productions.

WOLVERINE TRUFIN*

—The integral finned tube

...cause of its one-piece construction—the ... ...ing extruded from the tube wall itself—Tr... ...ents many advantages for you. It will ... ...d vibration and sudden temperature chan... ...n important feature in heat transfer appl...

...is available in a wide range of sizes and ... ...ings—in copper, copper base alloys, a... ... 1010 welded steel and type 304 sta... ... and in bi-metal (aluminum fins and co... ..., Liners of other alloys can also be ...



PARTS MADE BY OUR SPUN END PROCESS†

Countless numbers of tubular parts can be produced better and more economically by the Spun End Process than can be done in any other way. This process—an exclusive Wolverine development—can provide an almost unlimited variety of tubular shapes; suggest more attractive and more practical design; decrease or even eliminate assemblies.

Our Spun End Tube Brochure has much helpful information for you. Would you like a copy?

*REG. U.S. PAT. OFF.

†A PATENTED PROCESS RE. 22485

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ont.

WOLVERINE TUBE DIVISION

of CALUMET & HECLA, INC.

ESTABLISHED 1916

Manufacturers of Quality-Controlled Tubing

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Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

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LOOK WHAT'S HAPPENING IN YOUR COOLING TOWER

HERE'S WHY KOPPERS PRESSURE CREOSOTING ON HALSTEAD & MITCHELL COOLING TOWERS IS VITAL FOR LONG LIFE

WHY CREOSOTED WOOD?

Rough-cut wood simply "wets" more effectively than any other suitable material. Constantly wetted wood is subject to immediate attack by fungus and marine parasites. Creosote is the most permanent and positive preservative for timber . . . *containing 162 elements* toxic to fungus growth and parasites . . . proved by over 100 years of use. All wood used in Halstead & Mitchell Cooling Towers is pressure-creosoted.

WHY KOPPERS PRESSURE-CREOSOTING?

Wood preservatives must penetrate deeply to be effective; a surface coating can be worn or broken through and the wood is then under immediate attack. Koppers Pressure-Creosoting gives the deepest possible penetration and longest possible life. Therefore, Halstead & Mitchell wetted decks are Koppers Pressure-Creosoted.

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE

against rotting by fungus attack

2 thru 100 Tons

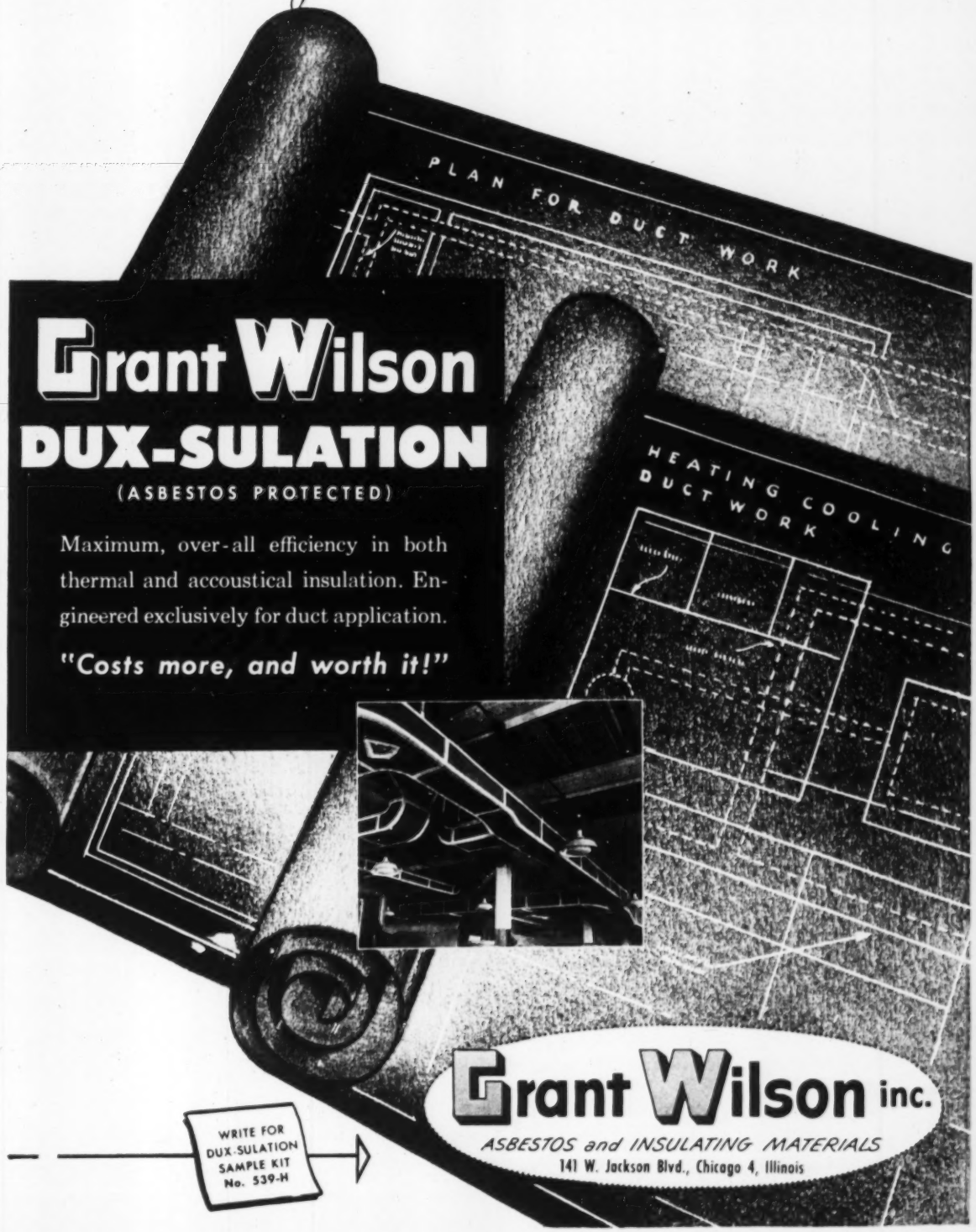
Sheet-Steel Cabinets,
3-times protected
Stainless Steel Fans and Shafts
Weather Shielding
Gravity-Type Distributing Pans
—no windage loss
Everdur Bolts for ease of
disassembly at any time.

Write for Catalogs

HM Halstead & Mitchell

OFFICES: Bessemer Bldg., Pittsburgh 22, Pa.

For projects where nothing but the BEST is desired.....
where nothing less than the BEST is acceptable....



Grant Wilson
DUX-SULATION
(ASBESTOS PROTECTED)

Maximum, over-all efficiency in both thermal and accoustical insulation. Engineered exclusively for duct application.

"Costs more, and worth it!"

WRITE FOR DUX-SULATION SAMPLE KIT No. 539-H

Grant Wilson inc.
ASBESTOS and INSULATING MATERIALS
141 W. Jackson Blvd., Chicago 4, Illinois

They Give...

PERMANENT PIPE-LINE SECURITY

From *Master* Craftsmen come the world's finest *FITTINGS* . . . drop forged from solid billets of specially blended *STEELS.*

Your pipe connections can be harmonious and lasting . . . even endure beyond the normal life of the system . . . if proper consideration is given the compatibility of their meeting. Many millions of feet of pipe and tubing have been brought together by W-S Double-Diamond Forged Steel Fittings in lasting unions against time . . . heat . . . pressure . . . turbulence . . . corrosion . . . oxidation . . . vibration . . . reduction and shock.

Such fortunate meetings withstand the adverse conditions of *ANY* service environments because W-S FITTINGS are inherently superior to those made by methods other than PRECISION MACHINING from solid FORGED stock.

Whatever your pipe or tubing application, you can profit from the permanence of W-S Double-Diamond (Screw-End and Socket-Weld) Forged Steel Fittings.

SOLD THROUGH LEADING DISTRIBUTORS

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

132 ALDENE RD., ROSELLE, NEW JERSEY

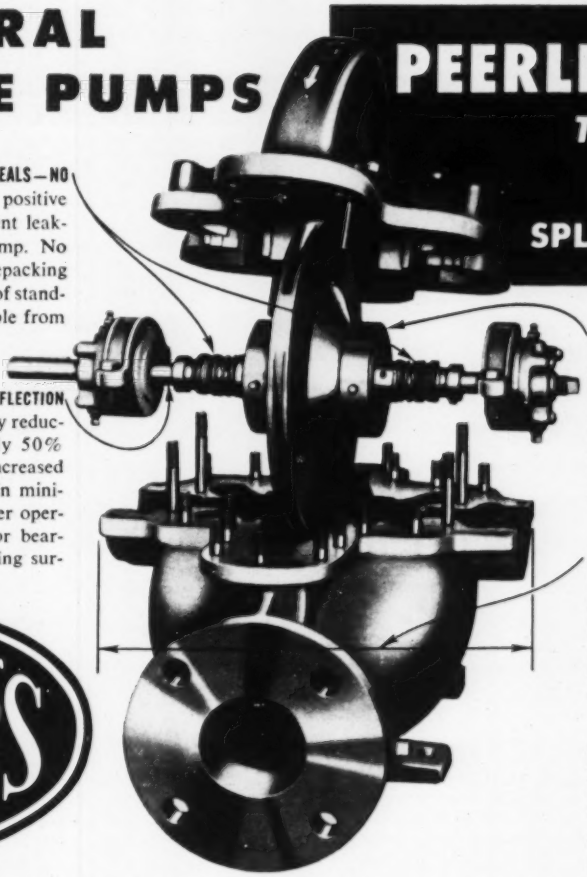
A NEW DESIGN

IN GENERAL PURPOSE PUMPS

PEERLESS Type AS HORIZONTAL SPLIT CASE PUMP

USES MECHANICAL SHAFT SEALS—NO STUFFING BOXES. Single positive acting, shaft seals prevent leakage of liquid from pump. No more down-time for repacking stuffing boxes. Seals are of standard design easily available from commercial sources.

SHORT SHAFT AND LESS DEFLECTION MEANS LONGER PUMP LIFE. By reducing shaft length nearly 50% Peerless has effectively increased shaft rigidity, resulting in minimum deflection, smoother operation and longer life for bearings, seals and all wearing surfaces.

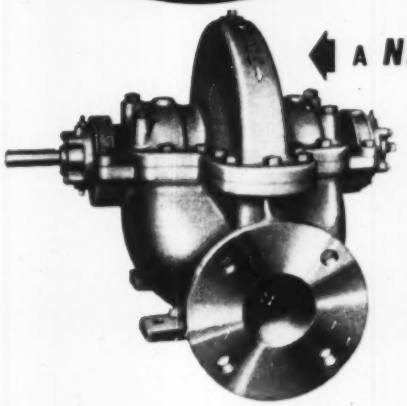


ENTIRE ROTATING ELEMENT LIFTS OUT AS A UNIT FOR EASY MAINTENANCE. Inspection or maintenance can be performed without disturbing piping connections or pump alignment. All parts on shaft can be removed with standard tools, on the job.

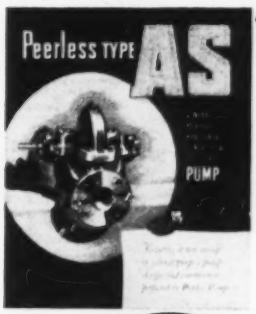
OCCUPIES HALF THE SPACE OF CONVENTIONAL DESIGNS. Floor space saving is made possible by elimination of packing gland housings. Provides more room for accessibility to piping, valves and control equipment.

CUSTOM PUMP—STANDARD PRICE. Type AS pumps cost no more than ordinary split-case pumps. Yet you get extra quality, without paying a premium. Proved in service.

PEERLESS PUMPS



A *NEW* PUMP DESIGNED AROUND MECHANICAL SHAFT SEALS



A *NEW* BULLETIN
that completely describes its advantages

Write for Bulletin No. B-1350 which completely describes and illustrates the modern design and construction features of Peerless Type AS pumps.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send us a copy of Bulletin No. B-1350 describing Peerless Type AS Pumps.

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COMPANY_____

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FOOD MACHINERY AND CHEMICAL CORPORATION
***Factories:* Los Angeles, Calif. and Indianapolis, Indiana.**
***Offices:* New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas, Plainview, and Lubbock, Texas; Albuquerque, New Mexico.**
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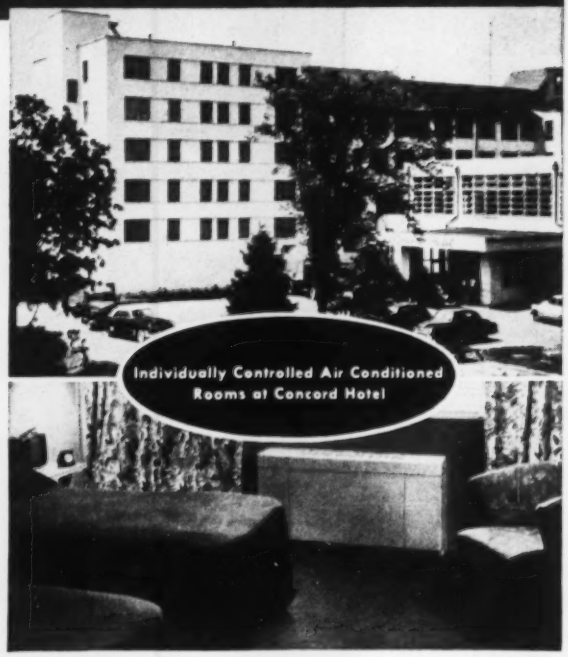
PEERLESS PUMPS
fmc

Another interesting REMOTAIRE installation!

Individual-room remote type units in resort hotel provide year 'round air conditioning

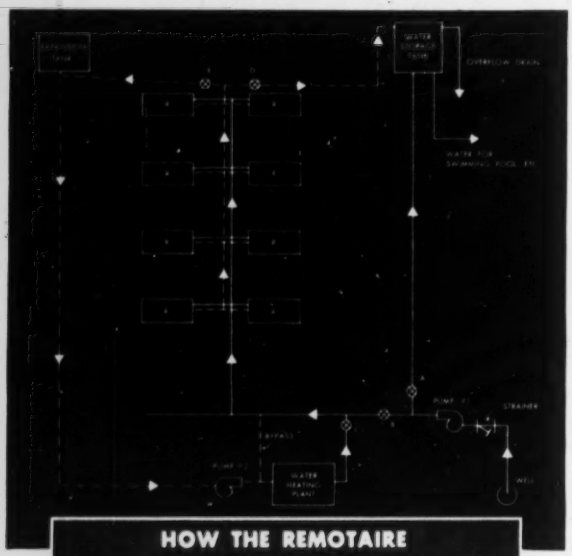
Summer cooling... winter heating



● The Concord Hotel, Kiamesha Lake, New York, found the answer to efficient, economical year 'round air conditioning through the installation of the Remotaire Well Water System—one of a number of different Remotaire systems available for multi-room buildings.

The Remotaire Well Water System may be used in localities where well water is known to be available in adequate supply, proper temperature, and of good quality. The cold well water is used in lieu of a water chilling plant. Consisting of Remotaire Room Units in each room connected by a piping system to the central plant equipment (as shown in the diagram), this system costs less to install and less to operate. Individual control of each Remotaire unit allows the occupant to choose the room temperature that suits him best without affecting adjoining rooms.

This resort hotel installation is another example of the versatility of the Remotaire for hotels, motels, hospitals, apartments, and other multi-room buildings.



HOW THE REMOTAIRE WELL WATER SYSTEM WORKS

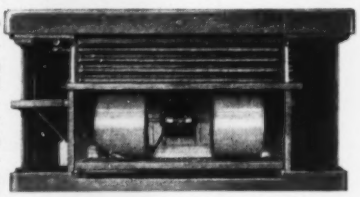
The Remotaire Well Water System consists of Remotaire Room Units in each room connected by a simple piping system to the central plant equipment—a well with pump, water heater, water circulating pump, expansion tank, storage tank and water filter or strainer as shown above.

FOR COOLING—Valves A and C are closed. B is open. Pump No. 1 pumps water from well to Remotaire units on each floor from which it travels thru valve D to storage tank on roof. This water is usable for swimming pool or other purposes.

FOR HEATING—Heating circuit includes Water Heater, Valve C, Valve E, Expansion Tank, Pump No. 2 and bypass. For operation, close Valves B and D, start Pump No. 2 and boiler, and the hot water circulates through the system.

When cooling is not required, well water may be used for other purposes, and can be pumped direct through Valve A to Water Storage Tank by Pump No. 1.

Top Quality Construction... Easy To Install



The Remotaire is sturdily built of heavy-gauge steel—plus a reinforced air grille—with a bonderized, baked-on semi-gloss enamel finish. All air passages are acoustically insulated for thermal efficiency and quietness. Coil is designed for right or left hand connections. Spacious end compartments permit easy access to coil connections and controls. Adaptable to a variety of ventilation systems, the Remotaire is ideal for modernization as well as new construction and is available in three models—200, 400 and 600 cfm.

Write for Remotaire Brochure, Form 298.

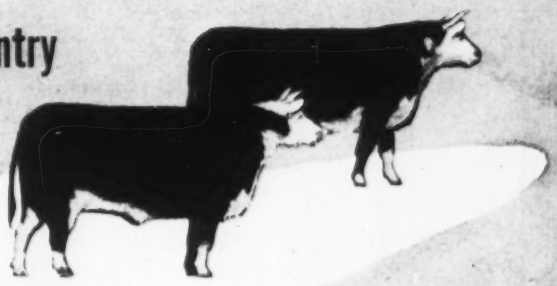
American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING-COOLING

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE
DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

100 miles of SPANG® CW steel pipe water the stock in the Texas "Big Bend" country



Water scarcity in the Texas "Big Bend" Country used to be a constant major crisis for ranchers. Back in the "old days," cattle and sheep were forced to walk miles and lose valuable weight in search of natural springs. And in drought years, cattlemen had to make superhuman efforts to save their herds.

But today, with pasturelands fenced in, ranchers are drilling wells in central locations and piping water to pastures. Down at Mitchell Ranch in Antelope Springs, Texas, 100 miles of pipe lines, varying from half a mile to 15 miles in length, carry water to the farthest points of the 192,000-acre ranch to water the 5,000 head of cattle.

The 863 tons of Spang CW Steel Pipe used in this project are arranged so that cattle will find water troughs no farther than a mile away from any point on the ranch. With this system, cattle are more contented and can maintain important weight for market.

Spang CW Steel Pipe will give the Mitchell Ranch years of dependable service, because Spang Pipe is quality-controlled throughout its manufacture. This means Spang is made of the best steel, is uniform in every way, is easy to cut, bend, thread and weld; and is tested and inspected before shipping to assure a perfect product.

Spang CW Steel Pipe is the first choice of engineers, architects and contractors for heating, plumbing and air conditioning systems. Next time you order pipe, tell your distributor you want Spang CW.

SPANG

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

HEATING PUMPS

To always meet

ALL REQUIREMENTS

CHICAGO INDUSTRIAL PUMPS

Chicago's complete line of heating pumps are designed to meet the specific and exacting needs of building service. When you specify Chicago Heating Pumps you can be certain you will always get the correct pump for the job.

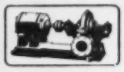
You can get the complete data on any or all series of Chicago Heating Pumps simply by writing for the technical Bulletin referred to under each type. This information is truly complete—includes engineering, specification and dimension data, as well as performance records, charts and tables.

CHICAGO PUMP COMPANY

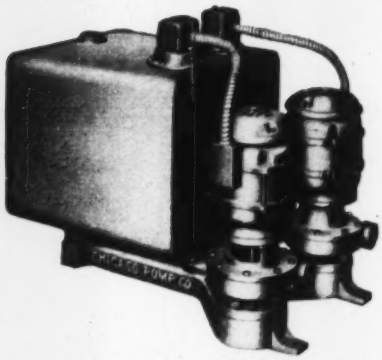
BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems



Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use

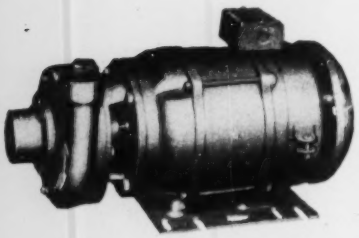


SURE RETURN CONDENSATION PUMP & RECEIVER

For systems up to 75,000 EDR and for low and medium pressures. Available in either single or duplex units. The base serves as a large capacity manifold through which the condensate flows by gravity from the receiver to the pump. The Sure Return will not steam bind. Described in Bulletin 250.

TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER

Specifically designed for low return service and underground installations. Flanges are accurately finished and gasketed to prevent steam leaks. Pump and receiver are shipped as a unit, ready to install. For 1000 to 40,000 EDR and 10 to 25 lbs. pressure. Described in Bulletin 255.

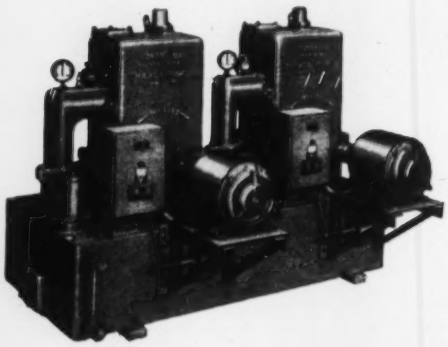


C-C CLOSE-COUPLED SERIES PUMPS

C-C Series Pumps combine pump and motor in a single compact unit for easy installation, eliminating coupling and alignment problems, and are equipped with the leak-proof CHICAGO mechanical seal. Each pump operates over the entire range of its curve without motor over-load.

DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP

Specifically designed for vacuum heating systems. The water capacity of the Condo-Vac remains constant up to the boiling point. The air capacity remains constant to the evaporation point. Pressures up to 40 lbs. Capacities from 2500 to 150,000 EDR. Described in Bulletin 270.

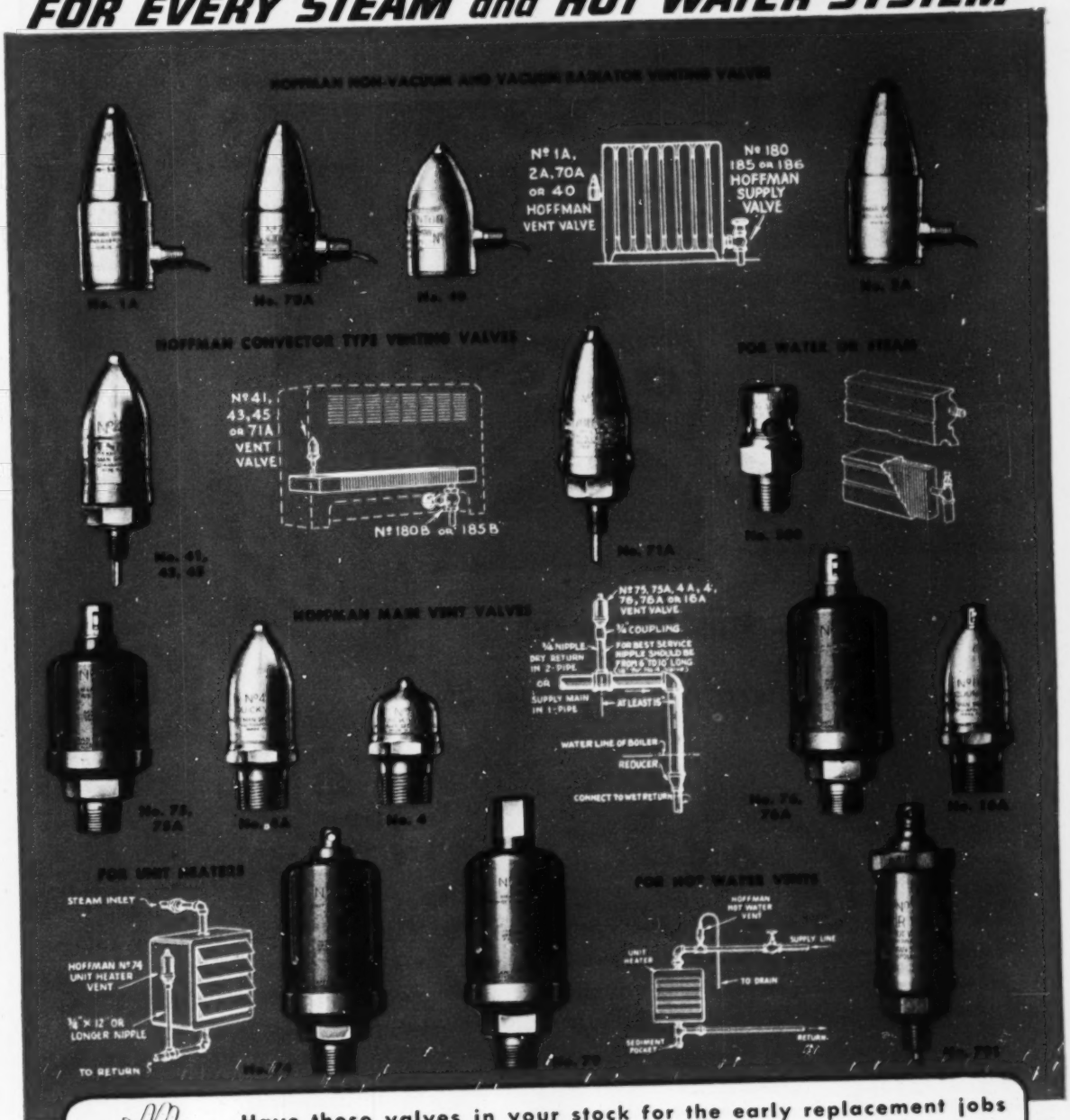


TYPE AVC CONDENSATION PUMP & RECEIVER

Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Sets on floor—no foundation bolts necessary. Weight of unit and piping hold unit firmly in place. For 500 to 10,000 EDR and 10 to 30 lbs. pressure. See Bulletin 245.

HOFFMAN VENTING VALVES

FOR EVERY STEAM and HOT WATER SYSTEM



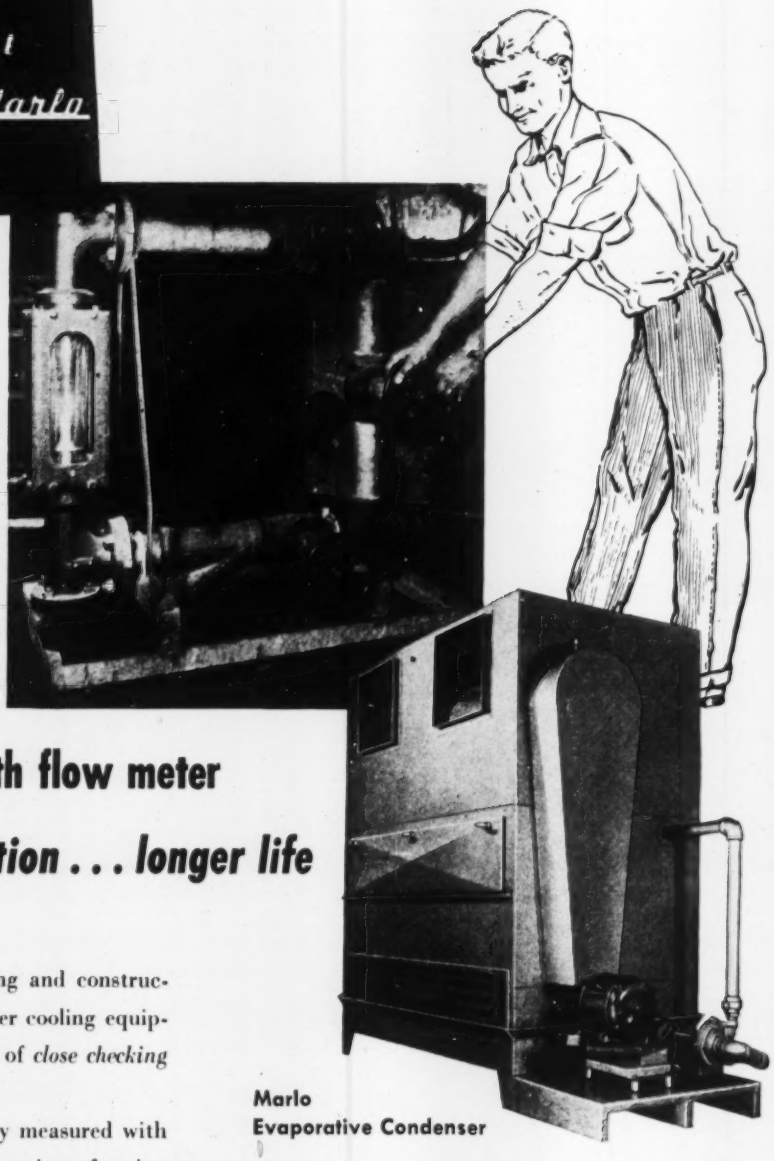
Have these valves in your stock for the early replacement jobs

For either one-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman assures you the correct Vent Valve for each specific requirement. Radiator Valves all feature the hinged drainage tongue. For the hard-to-balance radiators, the Hoffman line includes adjustable-port valves, available for vacuum and non-vacuum systems. It is not too early to order adequate stocks of main and radiator vent valves for modernizing jobs. Call your wholesaler.

HOFFMAN SPECIALTY MFG. CORP. • 1001 York Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps . . . Sold by Leading Wholesalers of Heating and Plumbing Equipment

You get MORE than just equipment when you specify Marlo Air Conditioning



for example . . .

Marlo

checks pumps with flow meter to insure *better operation . . . longer life*

To the superior engineering and construction of the pumps on Marlo water cooling equipment are added the plus values of *close checking and testing* before delivery.

The rate of flow is carefully measured with a flow meter to assure that the pump is performing most efficiently for the capacity requirements.

Shaft rotates on double-roll sealed ball bearings. Impellers are bronze, dynamically balanced to reduce vibration to a minimum.

Marlo
Evaporative Condenser

Such scrupulous attention to little details of construction and operation is a principal reason why MARLO QUALITY PAYS IN THE LONG RUN.

Marlo COIL COMPANY

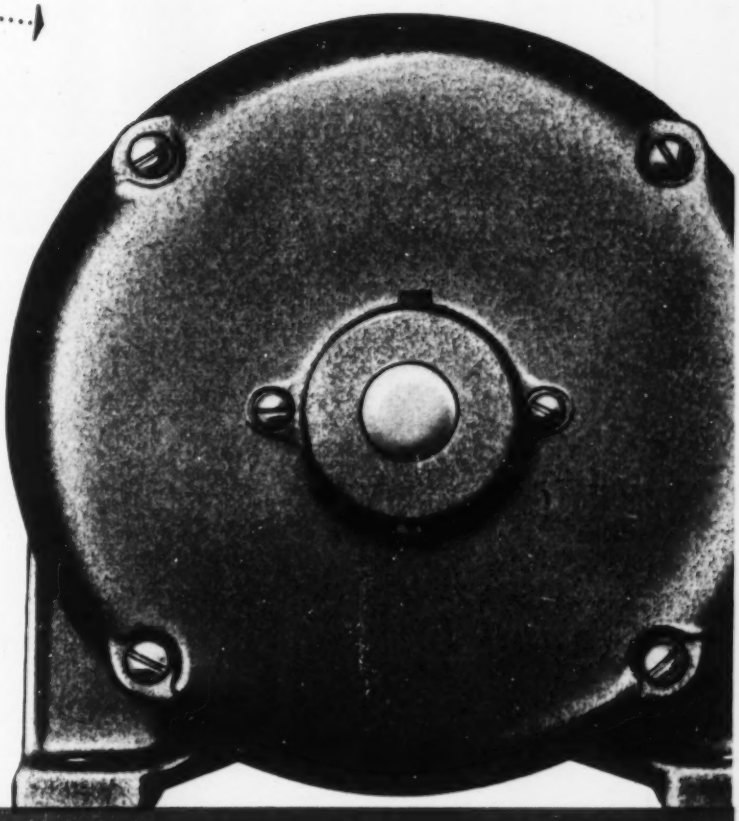
Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

DEPENDABILITY...
that builds dividends
Delco Motors

Delco integral motors are one item of manufacturing cost that does not come under the head of "variable." They are so consistently dependable in operation that they have a stabilizing effect on production costs—and on dividends.

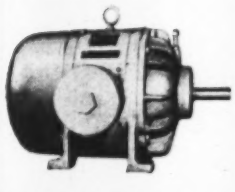
There are Delco motors for most applications—motors that will fit into **your** needs. A sales engineer from any one of the offices listed below will respond to your inquiry.



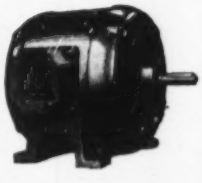
DELCO DAYTON OHIO

DELCO PRODUCTS

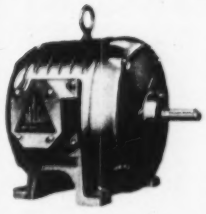
Division of General Motors Corporation
Dayton, Ohio



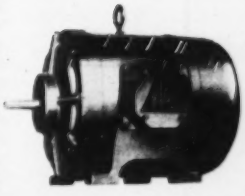
Explosion-Proof Motor



Open Ball-Bearing Motor



Totally Enclosed Motor



Totally Enclosed Fan-Cooled Motor

SALES OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Hartford • Philadelphia • St. Louis • San Francisco

Spartanburg schools are proud of their Will-Burt Stokers

SPARTANBURG CITY SCHOOLS
SPARTANBURG, S. C.

J. G. McCRACKEN
SUPERINTENDENT

ANN E. BULL
SECRETARY

October 30, 1952

Will-Burt Stoker Company
Orrville, Ohio

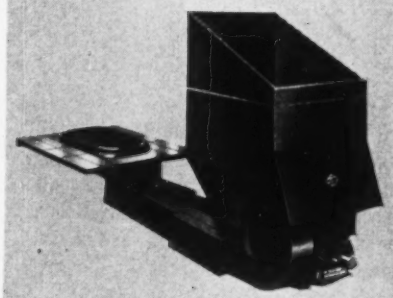
Gentlemen:

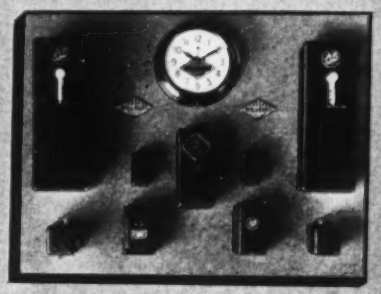
We would like to take this opportunity to tell you how pleased we are with our Will-Burt equipment. During the past summer we remodeled our boiler room at the Spartanburg High School and installed two of your 600# Hopper Type Dead Plate stokers. Also, installed was your #PB2K Will-Burt stoker control panel board inter connected for the operation of two Will-Burt stokers. We are very proud of this installation and would recommend Will-Burt to anyone interested in stoker equipment.

Sincerely yours,
J. G. McCracken
J. G. McCracken
Superintendent

JGMc:B

This installation was designed by J. C. Harrison, Consulting Engineer, Spartanburg, S. C. The equipment was sold through Montgomery and Crawford, Inc. and installed by the A. D. Carter Company, both of Spartanburg.





Write today for the details on the complete Will-Burt line of bin-feed and hopper model stokers and the new Will-Burt stoker control panel. If you want to specify and sell the most efficient, most reliable coal heating installations, you need to know about Will-Burt.

WILL-BURT

THE WILL-BURT COMPANY

BOX 902 ORRVILLE, OHIO

STOKERS • RESIDENTIAL BOILERS • OIL AND GAS CONVERSION BURNERS

all in one
Alco Multi-Outlet Thermo Valve

This one simple control does the work of many small valves or expensive distributor headers.

It feeds all circuits equally . . . regardless of load changes.

results..... The entire evaporator always works at peak efficiency. Compressor running time and operating costs are cut.

On many installations, Alco Multi-Outlet Thermo Valves have increased coil capacity up to 35%.

Available for all refrigerants and applications from 2 to 36
Ask for bulletin 180, or if for Ammonia, bulletin 172.

SEE YOUR ALCO WHOLESALER

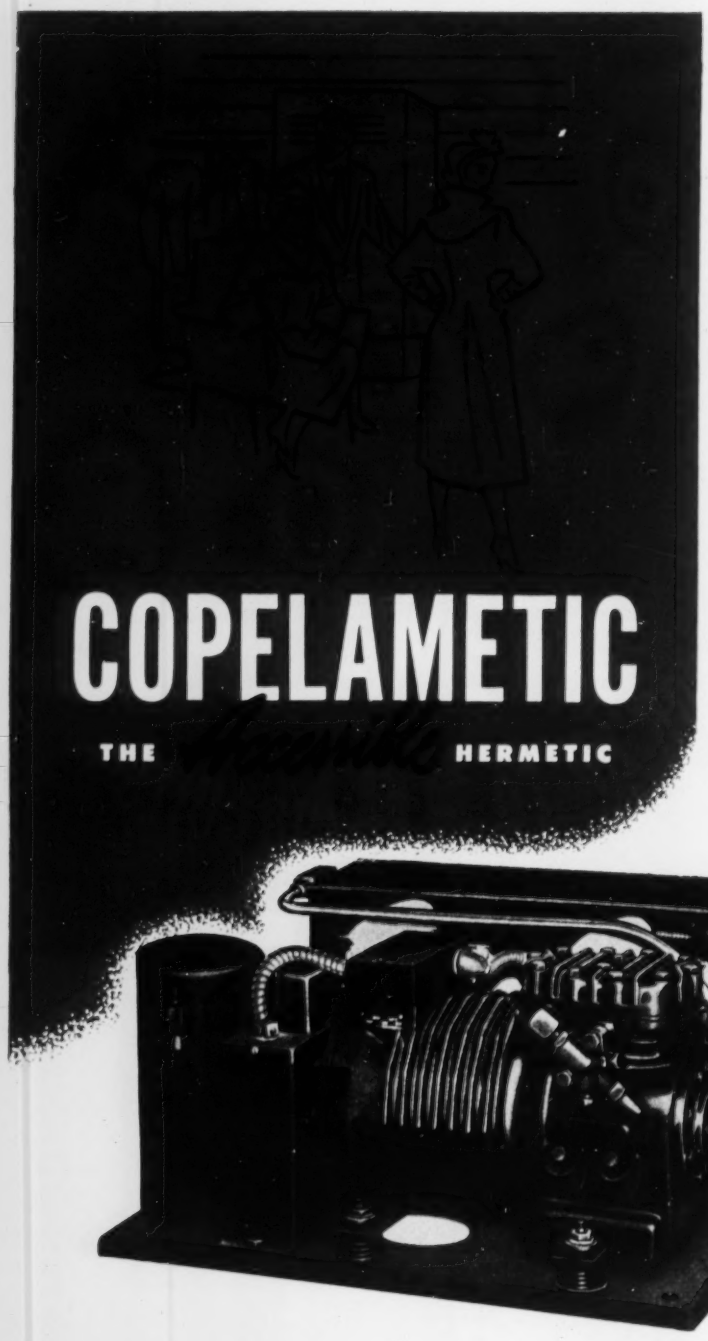
ALCO

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5713



compact . . . dependable . . . quiet . . .

Compact . . . dependable . . . quiet. Those are the prime requirements for the refrigeration unit in any air conditioning system. Add to them ruggedness, accessibility and long life and you have the COPELAMETIC.

For the unit that has everything, look to Copeland the pioneer. Practical-minded engineers designed this modern unit without belts, seals or manual oiling, and to top that they made it accessible for servicing on the spot. Specify COPELAMETIC and be sure of a satisfied client for years to come.

There's a Copeland unit for every type air conditioning installation from smallest to largest. Air-cooled, remote COPELAMETICS are made from 1/4 thru 3 HP. There are water-cooled, remote units from 1/3 thru 7-1/2 HP. Self-contained COPELAMETICS are available for all applications. For complete details, write us or call your refrigeration dealer.

MODEL DE-100 ILLUSTRATED

REFRIGERATION UNITS (OPEN TYPE AND COPELAMETIC) WATER COOLERS

COPELAND REFRIGERATION CORPORATION • SIDNEY, OHIO

Any way you look at it this Thermometer is *Easy Reading*

You've been asking for a dial thermometer like this—A thermometer that can be positioned and firmly locked at any practical angle—now you can have it!

No stretching or straining to see this thermometer. Easy to adjust to required new positions before or after installation. No risk of the multi-angle selector working loose. A specially designed selector assures positive locking at every practical mounting angle and a few turns of *one* nut lock the selector securely.

These instruments, supplementing USG's complete line of Gotham temperature indicators, are designed to fit all standard connections and are available in all standard ranges. If you have a number of applications requiring "odd angle" mounting these new multi-angle thermometers will reduce the number and variety of instruments you have to carry in stock.

Before you order an angle thermometer be sure you see USG's new Gotham Multi-Angle Thermometer.

ADVANTAGES

1. Positive locking in every conceivable angle.
2. Reduces the number and variety of instruments required in your maintenance stock.
3. Provides that extra "odd angle" instrument which normal stock does not furnish.
4. Easy to change to any desired angle, before or after installation.
5. Saves engineers time when writing specifications.
6. Affords easy reading at odd angles.

UNITED STATES GAUGE

Dept. 8
United States Gauge
Division of American Machine and Metals, Inc.
Sellersville, Pa.

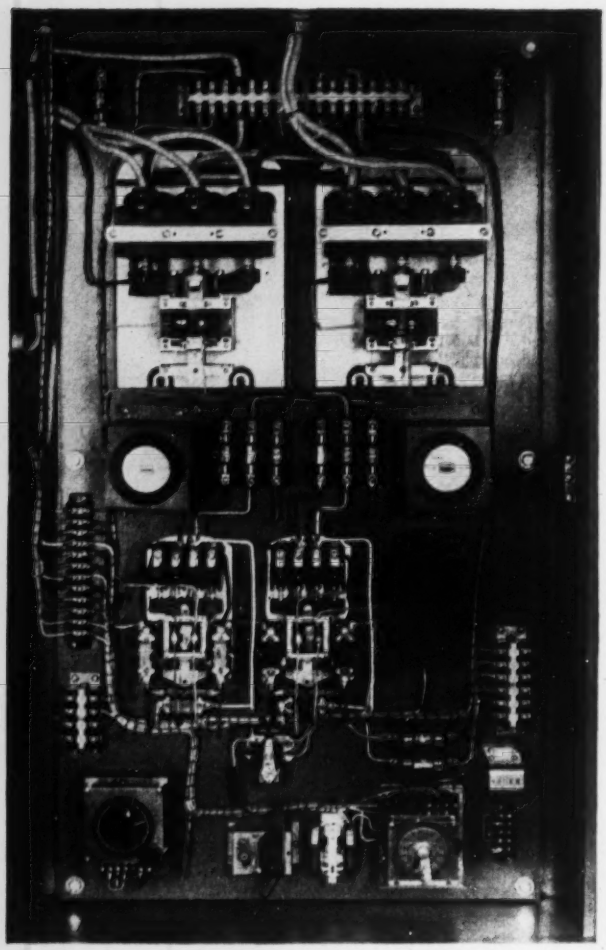
Gentlemen:
We'd like to know more about the new USG Multi-angle Thermometer. Please get in touch with us.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____



INTERIOR OF CONTROL PANEL shows two Ward Leonard three-pole contactors (near top of photo) and two motor starters (lower half of photo).

Dehumidifier controlled by Ward Leonard contactors and starters

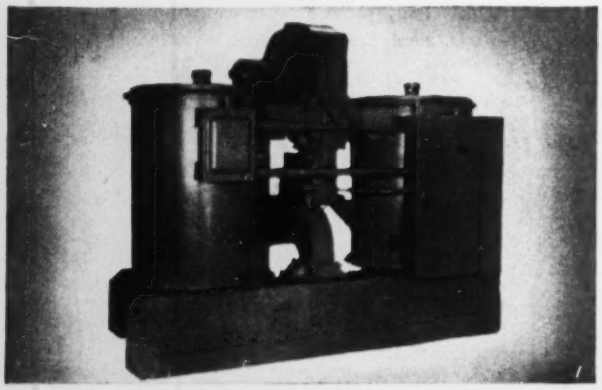
Two Ward Leonard three-pole solenoid contactors and across-the-line starters are an integral part of the control panel of the Desomatic Model DOR-800 Adsorbent Dehumidifier.

Daly, Merritt & Sullivan of Falls Church, Virginia, who manufacture the dehumidifier, needed electrical control components that could be readily installed in a custom control assembly.

The Ward Leonard contactors and starters which they selected fit this requirement because both are self-contained units . . . this results in simplified assembly, fast mounting and easy wiring.

Whatever the electrical requirements of your product, our engineers will be glad to help you select dependable controls to meet them. Write to Ward Leonard Electric Company, 24 South Street, Mt. Vernon, N. Y.

3-35



DESOMATIC DEHUMIDIFIER is used for preservation of equipment during long storage in warehouse buildings.

WARD LEONARD ELECTRIC COMPANY
MOUNT VERNON, NEW YORK

Result-Engineered Controls Since 1892

Ward Leonard's complete engineering text book, "Handbook of Power Resistors," $3 per copy

Let us slip these into your Active file

1 The MICROLITE Descriptive Brochure

What it's made of and how it's made; what its properties are; tables on thermals and acousticals; sizes; densities—all set up for quick reference.

2 The MICROLITE Hand Sample

"Proof of the pudding"

3 New MICROLITE Application Manuals

Full of photos and "down-to-earth" facts that will actually prove you can't afford to do your next job without a close look at Microlite.

- Duct Cover Insulation
- Steam Tracer Lines and Nested Pipes
- Valves and Fittings
- Domestic Boilers and Warm Air Furnaces

Here are the properties of MICROLITE that mean something to you!

- **LIGHT AS A FEATHER**
  means large pieces can be handled easily
- **NON-ITCHING SOFT**
  means no more work gloves
- **HIGH TENSILE TOUGH**
  means you can pull it snug around ducts and pipes, tie it up and staple it easy

CLIP AND MAIL TODAY!

GLASS FIBERS INC., 1810 Madison Avenue—Toledo 2, Ohio

Yes, I'm interested in what Microlite can do for me. Please send the following pieces of literature by return mail:

- ☐ MICROLITE DESCRIPTIVE BROCHURE
- ☐ MICROLITE Application Manual: HEATING and AIR CONDITIONING DUCTS
- ☐ MICROLITE Application Manual: STEAM TRACER LINES and NESTED PIPES
- ☐ MICROLITE Application Manual: VALVES and FITTINGS
- ☐ MICROLITE Application Manual: DOMESTIC BOILERS and WARM AIR FURNACES
- ☐ YES, Send me a sample of MICROLITE

NAME _____ TITLE _____

COMPANY _____

STREET ADDRESS _____

CITY _____ ZONE _____ STATE _____

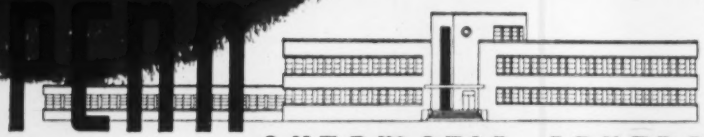
Old Man Winter is at the door!
take a good look at your heating system . . . now!
Remember last winter? Well . . . there's no good reason for you and your family to suffer through another uncomfortable heating season of being *too hot, then too cold.*
Here's all you do. See your heating dealer now . . . ask him to show you how a *modern* automatic heating system controlled by the *modern* PENN *heat-anticipating* room thermostat *definitely* stops Hot-n-Cold living.
The PENN thermostat is no ordinary thermostat. It not only "feels" the changes in room temperature but *senses them in advance.* This amazingly accurate thermostat with its PENN-made magic of "heat anticipation" keeps room temperature within 1° regardless of outside weather conditions. And that's *real heating comfort for you and your family!*
Whether you buy a new heating plant or modernize your old one, *insist* on PENN Controls . . . they cost no more but give *much more in comfortable living.*
Penn Controls, Inc.
Goshen, Indiana
COMFORT around the clock
For greater comfort, convenience and fuel economy, also get the PENN Tem-Clock. It lowers the temperature at bedtime so you can enjoy the restful sleep of a cooler home. Then, in the morning *before you arise,* Tem-Clock brings temperature back to daytime level. And it's all done *automatically!*
ENGINEERED CONTROLS
PENN
AUTOMATIC CONTROLS
Selected by leading manufacturers for over 30 years
FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS APPLIANCES

IT STARTS buying action WHEN YOU WANT IT!

Now . . . *before* the winter rush . . . is when you want your heating prospects to modernize their heating systems. These Penn Control ads help you get 'em going. They direct your heating prospects to see you *now* for more comfortable living this winter . . . they *pre-sell* your prospects on automatic heating with Penn's heat-anticipating thermostat and Penn heating controls . . . they make your heating sales job easier.

It's up to you to cash in on these free Penn salesmen! See your heating prospects right away . . . show them how to end Hot-n-Cold living with the Penn heat-anticipating thermostat . . . tell them why Penn Controls are best for *any* heating system.

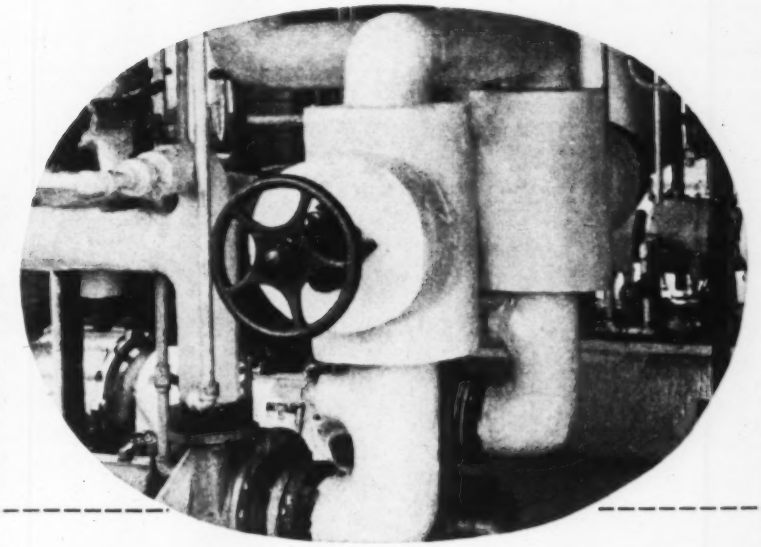
There are big heating profits ahead. Get your share . . . write for a supply of Penn consumer literature and sales aids. **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N.Y., U.S.A. In Canada: Penn Controls Limited, Toronto, Ontario.



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

Users agree that Swift's Lagging Adhesive is



Moisture and mold resistant

Swift's Lagging Adhesive resists the action of oils, fats, mold and vermin. What's more, Swift's Lagging Adhesive:

Is an excellent undercoating for paint, reduces penetration in lagging cloth . . . paint goes further.

Easy to use . . . brushes on without dragging. Dilute with water, if desired.

Safe! Won't support combustion. Is an inert resin emulsion base, free of inflammable solvents.

Saves time with a fast set . . . dries quickly to a strong, continuous film even under adverse humidity conditions.

Tops as a cement and size in applying modern insulations.

Call **SWIFT** first for **ADHESIVES**

SWIFT & COMPANY
Adhesive Products Department
Chicago 9, Illinois

This offer expires October 31, 1953

Please send me your _____ gallon introductory trial shipment of Swift's Lagging Adhesive at the quantity price, to be tested for use in our operations. We understand, if not fully satisfactory, it may be returned for credit at your expense.

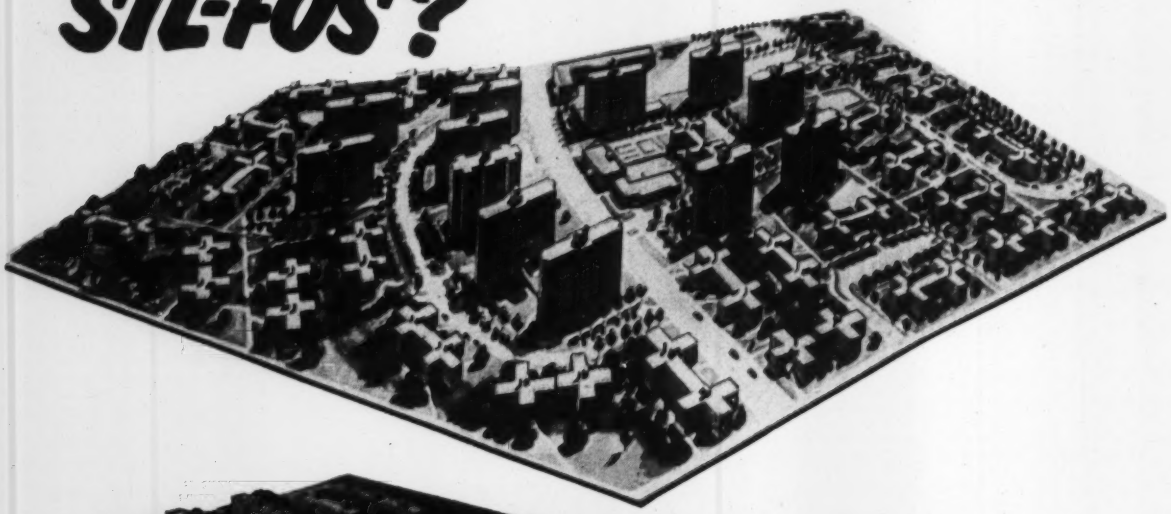
Name _____

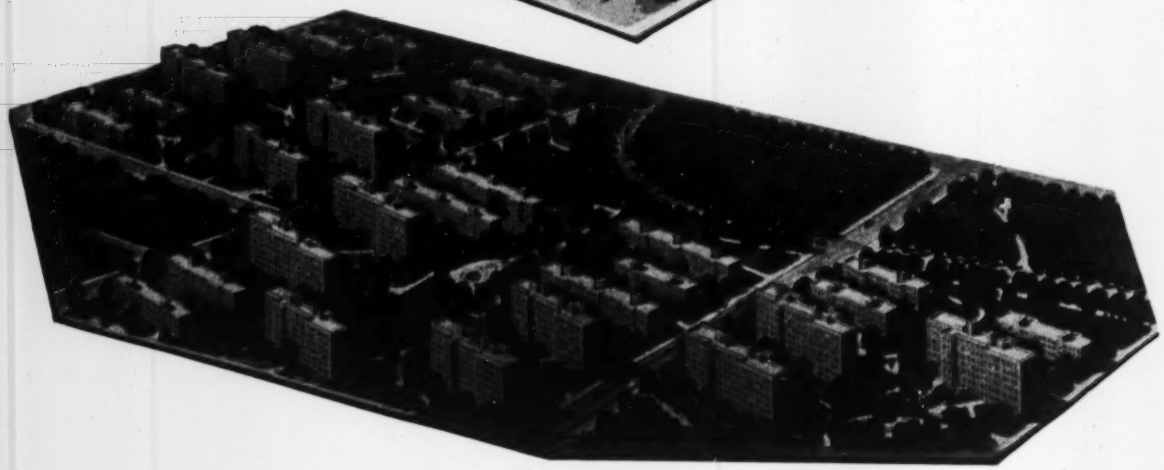
Firm Name _____

Address _____

City _____ *Zone* _____ *State* _____

WHY were all water lines in these low-cost housing projects silver brazed with SIL-FOS?





THESE TWO NEW PROJECTS in New York City's low-cost housing program comprise some 4000 apartments in 70 buildings.

WHY did the plumbing contractor elect to silver braze all hot and cold water lines with the low-temperature silver brazing alloy SIL-FOS?

The answer to that question is of vital interest to all plumbing contractors—especially those who have not as yet done any silver brazing of pipe and tubing. It comes direct from the plumbing contractor on both projects—one of the largest and most successful in the business—Eugene Duklauer, Inc.

IT'S IN THIS BULLETIN

It gives you Duklauer's eye-opening answer together with some interesting views of the piping and other valuable information about silver alloy brazing of pipe and tubing. Write today for your free copy. Ask for Low-Temperature Brazing News No. 61.

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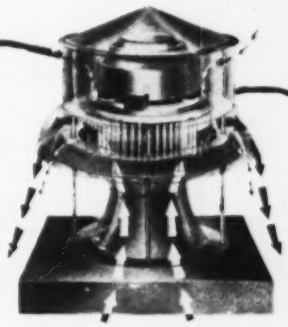
GALLAHER
RESEARCH REPORT

how to develop high static pressures
for power roof exhausters

Actual tests made of power roof exhausters show that, in the absence of scroll effect, a sharp decline in efficiency occurs as static pressure betters the quarter inch mark — and that scroll effect is necessary for efficiency at even normal static pressures!



Scroll Effect

A Patented design features of

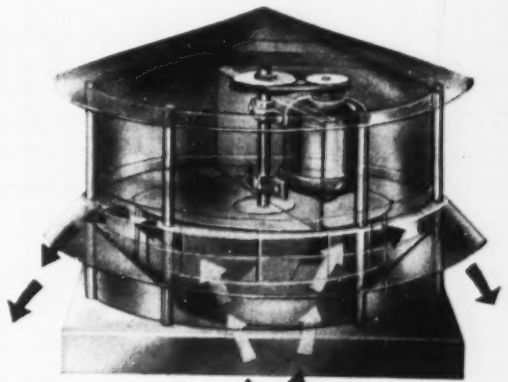
GALLAHER AIR-VANS

Research offered conclusive evidence that any other method than rating a power roof exhauster as it operates under actual conditions is inaccurate. Theoretical calculations are practically worthless . . . errors often run up to 50% and higher.

When exhausters are tested under *actual running conditions*, it becomes evident that even normal static pressure limited operating efficiency . . . a method of developing high static pressures in power roof exhausters has been designed.

Gallaher engineers designed the Air-Van with built-in patented *scroll effect*. This makes Gallaher Air-Vans the only power roof exhausters capable of developing high static pressures and large volumes of air. With this feature, thousands of industrial applications fall well within the range of economical Gallaher Power Roof Exhausters. And Gallaher ratings are accurate too, as attested to by an authoritive, nationally-known independent laboratory that determines ratings under conditions prescribed by the NAFM, ASH&VE and PREMA.

For performance-rated efficiency *plus* those other desirable features: economical installation, safe fume removal, low silhouette, weather-proof design and many others, investigate Gallaher Air-Vans. Ask your local Gallaher representative, or write to Department *H-9*.



Patents 2188741 2526290.
Patents pending

The GALLAHER Company
4108 DODGE STREET OMAHA, NEBRASKA

Send me full information on Gallaher Power Roof Exhausters.

NAME _____

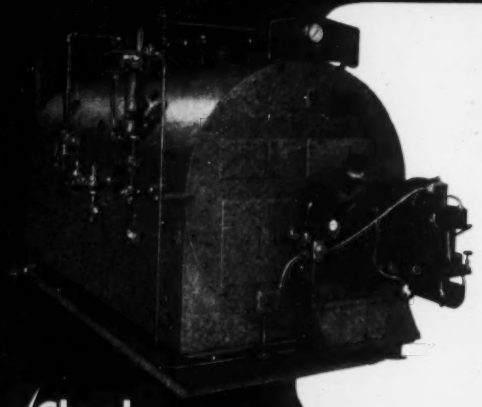
ADDRESS _____

CITY _____ STATE _____

SAVE FUEL-SAVE LABOR-

Choose Dutton!

TWO LINES TO SUIT YOUR NEEDS... BOTH FAMOUS FOR EFFICIENCY... LONG LIFE... LOW OPERATING COST



EconoTHERM...

the compact, automatic "packaged" boiler with exclusive Off-Center Firing

Compare it point-by-point — and you'll see *why* the EconoTHERM's advanced engineering *pays off* in fuel and labor saved! Off-Center Firing results in faster steaming and greater safety with guaranteed 80% efficiency. Completely automatic . . . amazingly compact . . . 5 or more square feet of heating surface per H.P. Gas or oil fired — to 250 H.P. Write for EconoTHERM Bulletin EC-52G.

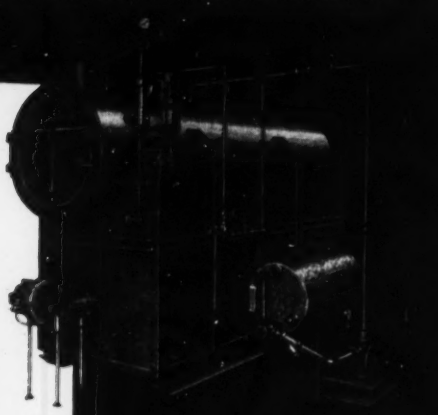
✓Check First with Dutton

OTHER TYPES AND SIZES 5 H.P. AND UP

EconoMIST...

gives you 5-way firing convertibility... plus reliable H. R. T. design

Install it for gas, light oil, heavy oil, stoker, or hand firing — you can later convert the EconoMIST to *any* one of these firing methods. Highly adaptable, it's above all tremendously *dependable*. Of all "packaged" units, EconoMIST sets the standards for operating simplicity and low maintenance costs. Sizes from 15 to 105 H.P. Write for EconoMIST Bulletin EC-52G.



Dutton BOILERS

DIVISION
HAPMAN-DUTTON COMPANY
KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

Handy Steam Cost Calculator mailed FREE on request... or ask your Dutton representative. (See Yellow Pages in Phone Book.)

What does Vulcan mean by . . .

VULCAN PREFERRED ?

IN THE "LONG RUN" IT COST LESS . . .
MOST COMPLETE LINE IN THE INDUSTRY
SAVES TIME, MONEY, MAN-HOURS ON THE JOB

In the "long run", Vulcan Radiation costs *no more* than ordinary heating.

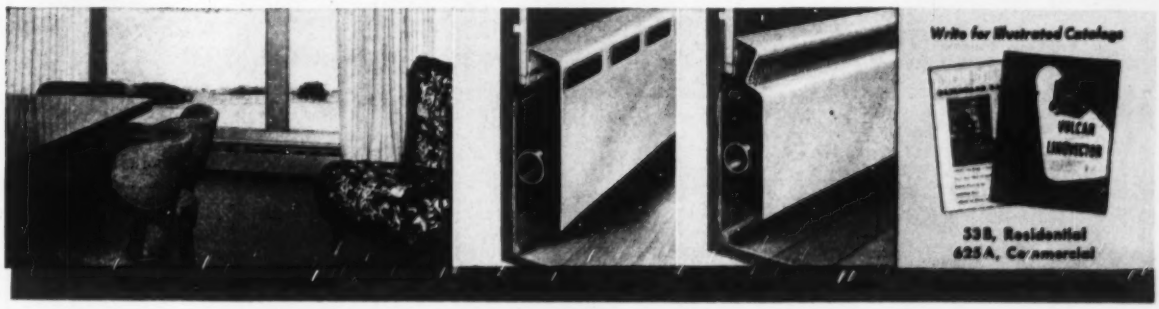
Vulcan uses premium-grade steel pressure-tube or hard-temper copper water-tube for *durability*. Fins are PERMANENTLY IMBEDDED for *rugged service*. Convenient lengths up to 12 feet . . . long lengths permit longer spans . . . fewer fittings between supports save money. Vulcan is *built* to last a *lifetime*. Best in the "long run" for *unequalled economy*.

Vulcan Radi-Vector* and Linovector* provide industry's *maximum range* of sizes and outputs. Large tubes permit long runs with low-pressure drops. High output per pound of material. Can be furnished curved for unusual applications. Engineered to *fit any plan* . . . regardless of requirements.

Vulcan's *easy-to-fit* accessories speed installations. End enclosures, front covers, corners and joining pieces, are *made right* to *fit right* . . . assuring swift, *trouble-free* assembly . . . saving time, money, man-hours on the job.

Made in Canada under Trade Name of Heal Radiation by the Vapor Car Heating Co. of Montreal

*Trade-mark reg.



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Over 28 Years A Leader (V) In Finned Tube Radiation

Representatives in Principal Cities

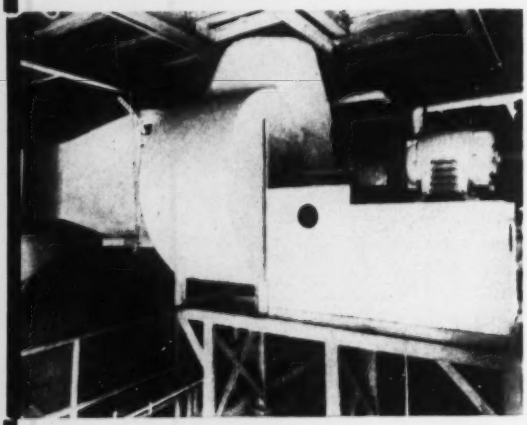
GENERAL BLOWER EQUIPMENT

COMPLETELY VENTILATES AND AIR CONDITIONS RESEARCH LABORATORY

A section of blower room showing centrifugal fans

General Blower has developed a rugged line of blowers with minimum impeller noise. They are engineered for quiet operation. All General Blowers have been time-tested, and operate efficiently under the most severe conditions. Installed herein for conventional ventilating requirements and also for exhausting fumes and gasses from chemist's hoods and laboratories, also large fans for heating and air conditioning.

Induced draft fans were installed on boilers (in this particular case eliminating the necessity of a smoke stack or chimney.



Induced draft fans serving boilers.

Research and Development Laboratory of Pure Oil Company, designed by Stone & Webster, Architects at Crystal Lake, Illinois.

LUNGS FOR INDUSTRY

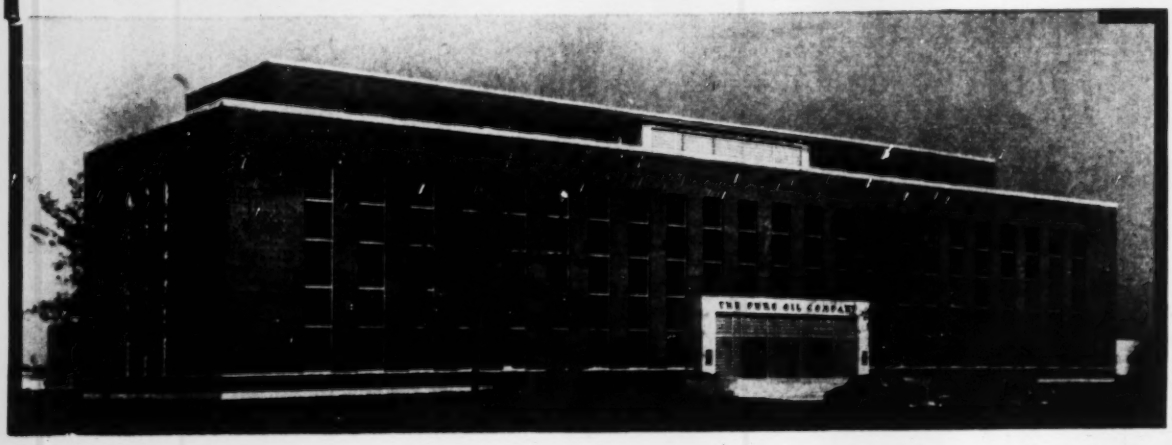
*General Blower ventilating fans are manufactured for Industrial and commercial ventilating and heating, fume extraction, induced draft, forced draft, air conditioning, drying and processing. They are of forward or backward curved wheel design. Type F.C. are designed for quiet operation at low speeds. Type B.B. are designed to operate at high speeds and have the non-overloading characteristics. Capacities of 200 c.f.m. to 300,000 c.f.m. are covered by standard sizes and arrangements.

For full particulars write for "Lungs for Industry"

GENERAL BLOWER COMPANY

8610 Ferris Street

Morton Grove, Illinois



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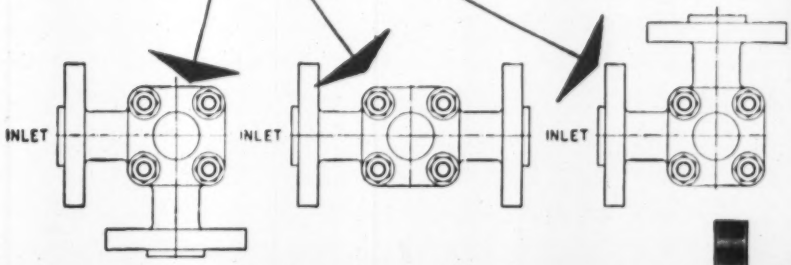
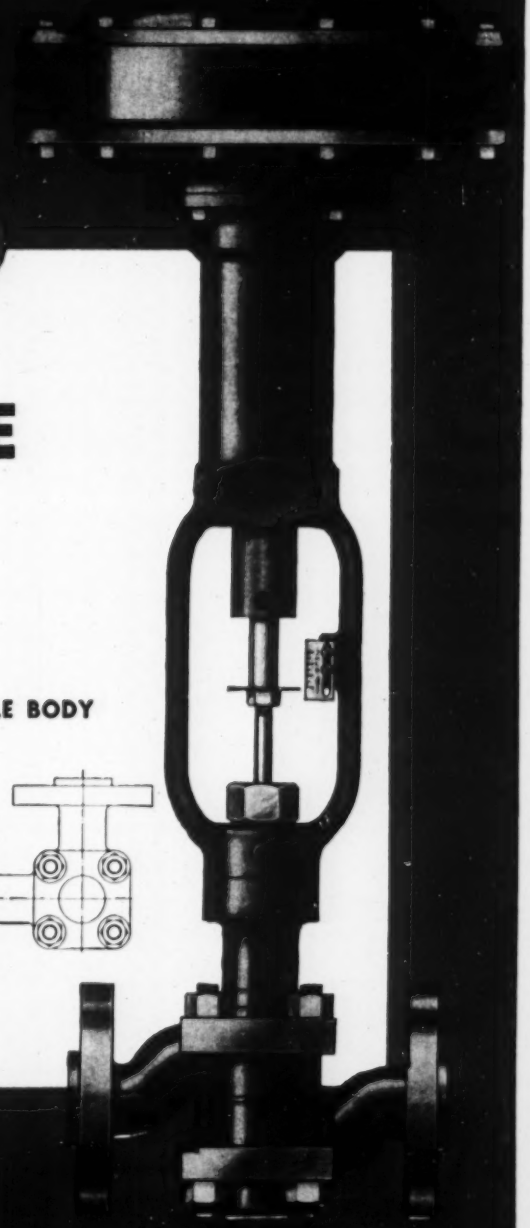
CAN BE EASILY CONVERTED TO OFFSET ANGLE BODY





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Since 1880

.... the BEST BUY for

INCREASED ATTENTION and LASTING SALES POWER

THE JANUARY 1954 ISSUE

and 20th Annual Directory Number of

HEATING, PIPING & AIR CONDITIONING

STANDARD EDITORIAL CONTENT . . . . . .

January HP & AC will be a "regular issue" in every respect. It will carry a full quota of timely articles, and the Journal Section of the American Society of Heating and Ventilating Engineers—the same as in every issue of this field-leading book. For extra attention value, it will have heavy covers, and be specially mailed.

DIRECTORY SECTION . . . .

Every product used in industrial and large building air conditioning, heating and piping will be listed. We'll tell who makes these products and their trade names. All advertisers as they appear in this Directory Section will be prominently identified indicating that more detailed information is elsewhere in the issue. It's the industry's best and most complete BUYING GUIDE—printed on colored stock in a special section.

Here's a regular issue, and a directory issue, combined in one great January number . . . . and *no advance* over regular issue rates!

Here your advertising will get *increased attention*, and have *lasting sales power* (as product reference copy) throughout all of 1954.

Here is the "best buy" of the year in our field . . . . the place where a convincing sales story of your complete facilities will do you untold good.

Here is where *extra* space for *extra* emphasis belongs!

Most advertisers use increased space with us in January —spreads, inserts, color. They catalog their entire lines. You, too, can profit most by doing a complete job. Make space reservation now . . . . we'll be glad to help with copy preparation if needed.

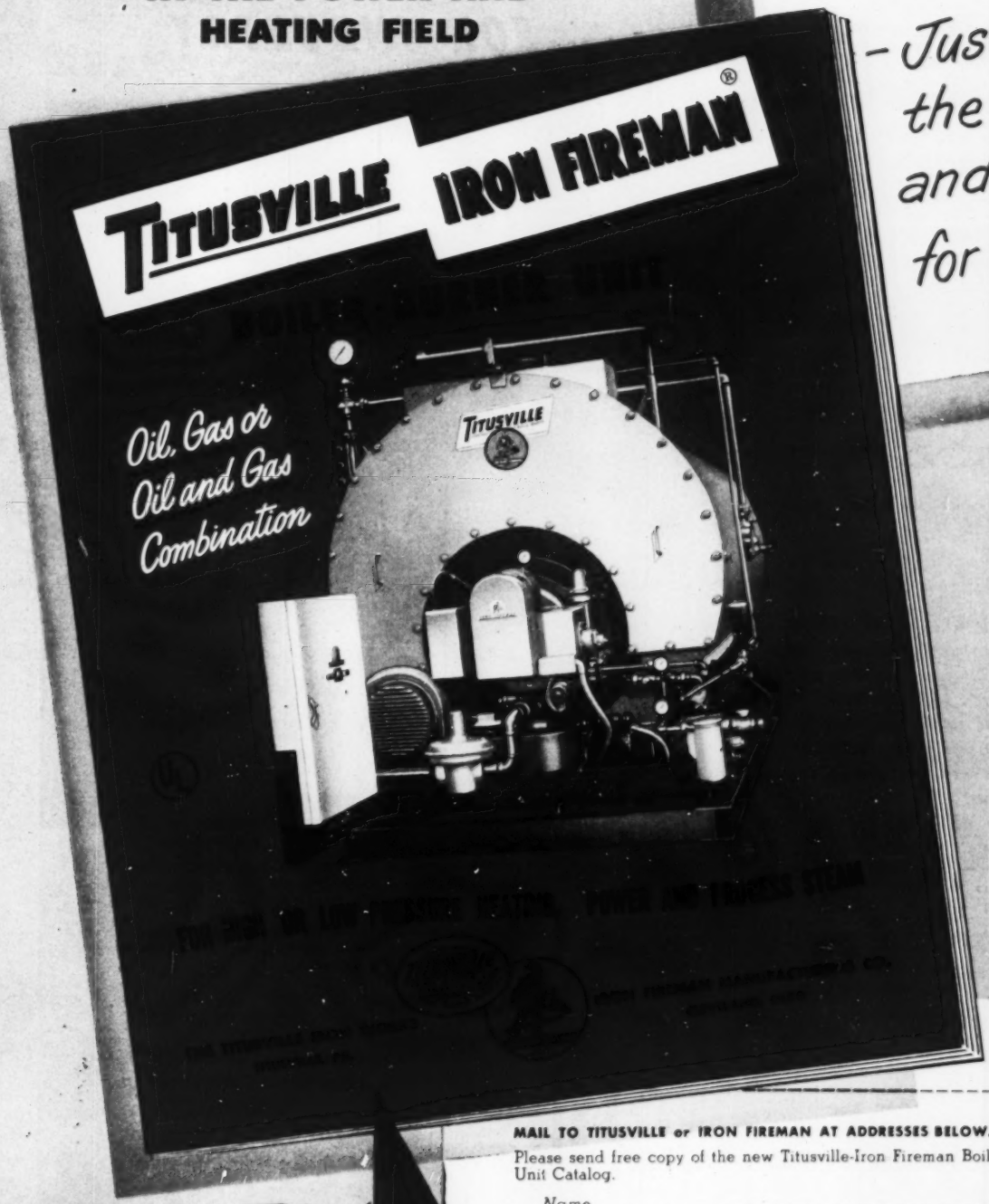
Heating, Piping & Air Conditioning

6 North Michigan Avenue

Chicago 2, Illinois

NOW - BIG NEWS

IN THE POWER AND HEATING FIELD



– Just off the press and ready for YOU!

MAIL THIS COUPON *Today!*

Fully illustrated, colorful 12-page catalog contains complete data and specifications on models, sizes, capacities, operation and advantages of the new Titusville-Iron Fireman Boiler-Burner Unit. This catalog yours without cost or obligation. Send coupon to Titusville Iron Works Co. or Iron Fireman Manufacturing Co.

MAIL TO TITUSVILLE or IRON FIREMAN AT ADDRESSES BELOW.

Please send free copy of the new Titusville-Iron Fireman Boiler-Burner Unit Catalog.

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Company _____

Street Address _____

City, Zone, State _____

Iron Fireman Mfg. Co.
3069 West 106 Street,
Cleveland 11, Ohio

Titusville Iron Works
311 S. Franklin St., Titusville, Pa.
Division of Struthers Wells Corp.

BRUNER

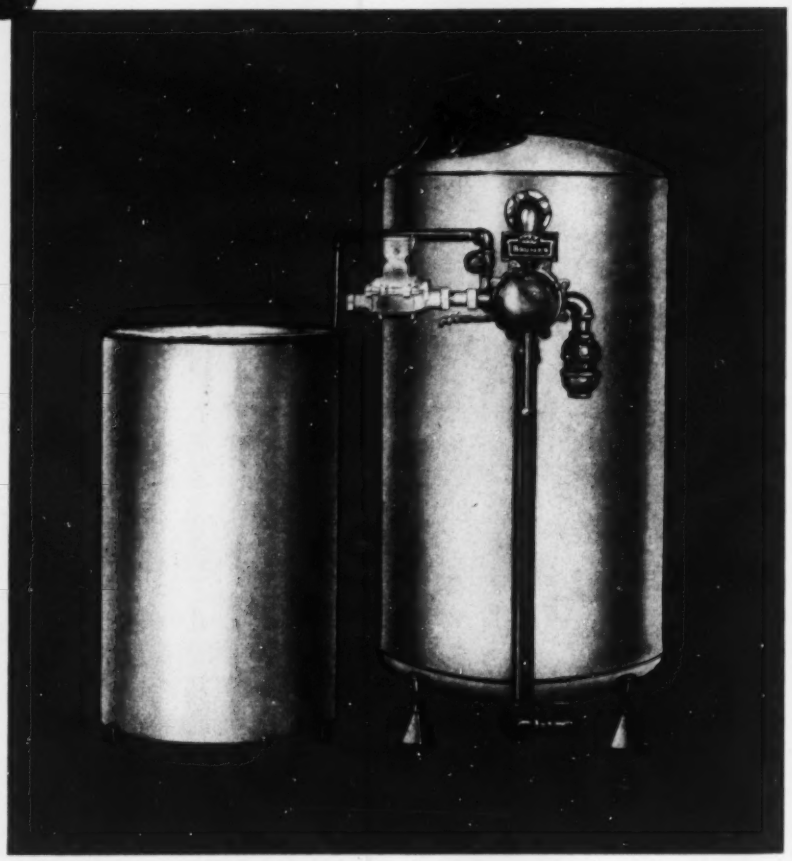
WATER SOFTENERS & FILTERS

WATER SOFTENERS
FOR INDUSTRY

Some recent installations of BRUNER industrial equipment:

- Flint, Michigan — Chevrolet Division, General Motors
- Amarillo, Texas — Pantex Ordnance
- New Orleans, La. — Jung Hotel
- Peoria, Ill.—Methodist Hospital
- Jacksonville, Florida — Jacksonville Power Plant #2
- Lansing, Mich. — Michigan State College
- Exeter, Calif. — Exeter Memorial Hospital

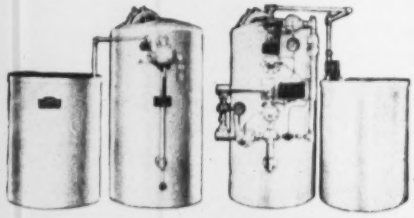
Hundreds of other huge installations of BRUNER softeners and filters from coast to coast and from border to border include almost every state in the Union.



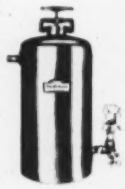
These new improved single units now available from stock, deliver 1,200,000 GR capacity with flow rate up to 150 GPM.

Twin units provide double capacity at twice the flow rate. Special units with up to 10,000,000 GR capacity at 800 gallons per minute can be supplied.

Bruner exclusive type automatic backwash control has no moving parts, guarantees no loss of mineral at high pressures yet assures positive cleaning of mineral bed at low pressures.
Dowex Lifetime Mineral is supplied as standard. Green sand or synthetic zeolite can be furnished. Your inquiry will receive prompt attention.



Dial-O-Matic and Sole Valve Heavy-duty models 80 to 160 GPM — 600,000 to 1,200,000 GR carried in stock.



Brucex Feeder for corrosion control.

"America's Most Complete Line of Quality Water Softeners and Filters".

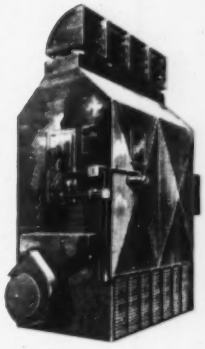
Offices in principal cities.

West Coast Plant and Office — 339 Indiana Street, El Segundo, Calif.

BRUNER CORPORATION • 2318 North 30th Street MILWAUKEE 45, WISCONSIN

Here's why Libby, McNeill & Libby chose..... DRAVO *Counterflo* SPACE HEATERS again for their 10 acre Hammond Warehouse

Food cartons at Libby, McNeill & Libby are stacked almost to ceiling level. Dravo Heaters were modified with sheet-metal extensions to raise discharge nozzles above stack level.



When Libby, McNeill & Libby acquired an existing warehouse at Hammond, Indiana, for use as a huge food-order assembly warehouse, a complete new heating system had to be installed. These were the problems Libby faced:

1. **Providing low-cost comfort heat and air conditioning throughout a 426,000 sq. ft. building area.**
2. **Preventing food from freezing in sub-zero weather.**
3. **Eliminating year-around dampness and humidity which caused rust on cans, loss of labels and carton damage.**

Based on previous experience with Dravo *Counterflo* Space Heaters in its other warehouses, Libby installed 30 Dravo Heaters in this building to overcome these problems. This is why Libby chose Dravo:

VERSATILITY—Dravo Heaters provide comfort heat and box-car de-icing in winter, summer-time ventilation and effective humidity control the year around for three-shift, 24-hour operations. Each heater operates independently and services its own area.

ECONOMY—Dravo Heaters' maximum air throw eliminated the need for ductwork except for several short runs, thus kept installation costs low. The Dravo recirculation system keeps roof-heat losses at a minimum; maintenance costs have been negligible.

EFFICIENCY—Dravo Heaters' automatic thermostat control maintains a uniform warm temperature throughout the warehouse in winter; no regular attendant is needed. Forced air ventilation removes humidity and eliminates food spoilage and packaging damage.

You, too, can benefit by installing Dravo *Counterflo* Space Heaters in your industrial or commercial building. Write today to obtain more information about low-cost, efficient heating for your business. *Use the coupon.*

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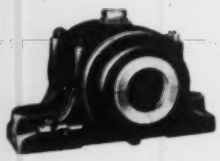
Send me information about heating for the subjects I've checked, and Dravo Heater Catalog VW-523-5768.

- ☐ Space heating industrial buildings, warehouses, garages, hangars.
- ☐ Stores, schools and auditoriums.
- ☐ Process drying and heat curing.
- ☐ Tempering make-up air.
- ☐ Temporary heating.
- ☐ For use in conjunction with air conditioning.
- ☐ Please have a representative call at no obligation to me.

Name _____ Title _____
Company _____ Address _____
City _____ Zone _____ State _____

WHEREVER QUIET IS REQUIRED

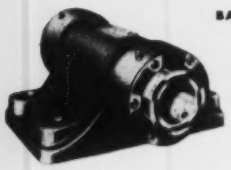


SLEEVOIL PILLOW BLOCK
A precision-built, ring-oiling babbitted bearing, self aligning and exceptionally quiet in operation.

WATER-COOLED SLEEVOIL
Sleevoil Pillow Block, designed for industrial applications where high temperatures are encountered.

DODGE BRONZOIL
Capillary bronze bushing has capacity of one-third its volume in oil. Reservoir with close fitting wick around bushing provides ample lubrication. Both pillow blocks and flange units.

BRONZE BUSHED PILLOW BLOCK
Designed for arrangement No. 2 installations. Two bronze bushings of high lead content mounted in one cast iron housing. Special T-section rings for dependable lubrication.



BALL BEARING PILLOW BLOCK
For anti-friction installations. Two single row, deep groove ball bearings in one cast iron housing. Extended inner races carry the shaft.

CALL THE TRANSMISSIONEER
your local Dodge Distributor, for information about the entire Dodge line of bearings for fan and blower service. Look for his name in the Classified Telephone Directory under "Power Transmission Equipment," or write to the factory.

DODGE BEARINGS FOR FAN AND BLOWER SERVICE

FOR INSTALLATIONS in hospitals, auditoriums, office buildings—wherever quiet operation is essential, Dodge offers the perfect answer to the bearing problem. Dodge manufactures a *complete line* of bearings for fan and blower service, all engineered and precision-built for exceptional quietness in operation.

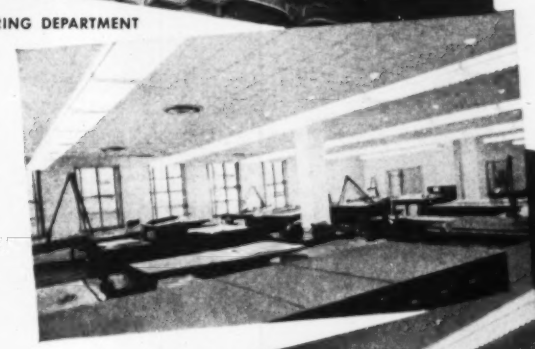
The Dodge line has been developed in close cooperation with the manufacturers of fan and blower equipment, to meet the specialized requirements in this field, efficiently and economically. For complete information on Dodge fan and blower bearings see your Dodge Distributor—or write the factory.

DODGE MANUFACTURING CORPORATION
1600 UNION STREET, MISHAWAKA, INDIANA

DODGE
of Mishawaka, Ind.

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

*CONFERENCE ROOM



*ENGINEERING DEPARTMENT

*OFFICE AREA

*CAFETERIA

COMFORT, COMFORT EVERYWHERE*

Laclede Gas Company,
Central Service Building,
St. Louis, Missouri

Architects: Russell, Mullgardt, Schwarz-Van Hoefen, St. Louis

Consulting Engineer: John D. Falvey, St. Louis

Heating Contractor: Sodemann Heat & Power Co., St. Louis

COMFORT is one big reason why so many Kno-Draft Adjustable Air Diffusers are going in these days. *Only Kno-Draft* permits adjustment of air volume and flow pattern *after* installation—assurance of uniform temperature *without drafts* throughout the conditioned area, greater comfort for occupants.

Beauty is an added consideration. Kno-Draft Adjustable Air Diffusers fit in with any style of decoration. Efficiency counts, too. Kno-Draft assures added economy in operation, offers the greatest flexibility to meet present and future conditions. There are Kno-Draft Adjustable Air Diffusers in types and sizes to meet all engineering and architectural requirements.

KNO-DRAFT DATA BOOK—NEW EDITION: Complete specifications, engineering and installation data on Kno-Draft Adjustable Air Diffusers. Write for your copy or send the coupon. No obligation, of course. Connor Engineering Corporation, Danbury, Connecticut.

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Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

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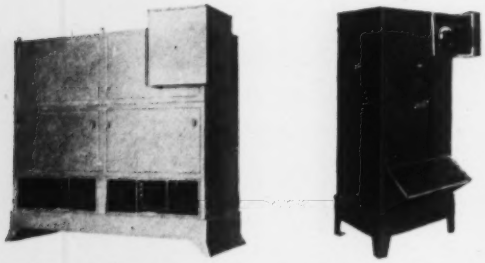
Position .....

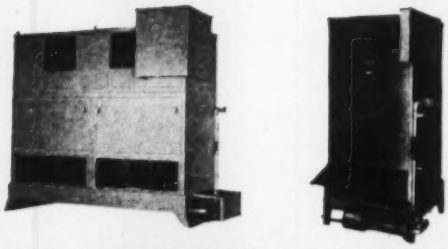
Company .....

Street .....

City ..... **Zone** ..... **State** .....



COOLING TOWERS—Air Conditioning, Refrigeration, or Industrial Applications. Outdoor-Indoor. 3 to 75 Tons. Catalogs No. CT-1 and KT-2.



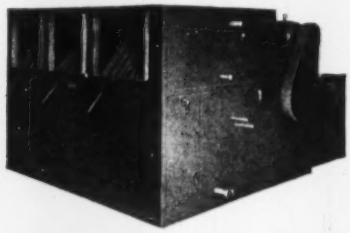
EVAPORATIVE CONDENSERS—Indoor-Outdoor. 3 to 75 Tons. Catalogs No. EC-1 and EK-3.

KENNARD *Engineered*

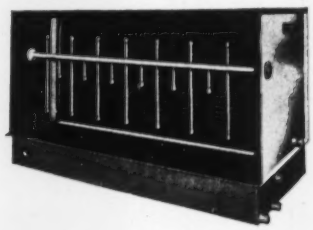
HEAT TRANSFER PRODUCTS

Architects, Consulting Engineers and Contractors have long known the quality performance of Kennard Heat Transfer Products. Now, more than ever, Kennard is being specified because of the many features frequently found only in Kennard products.

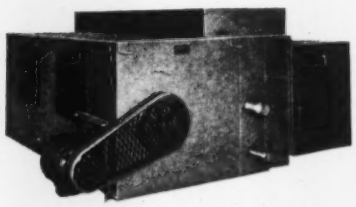
Specify Kennard on your next job.



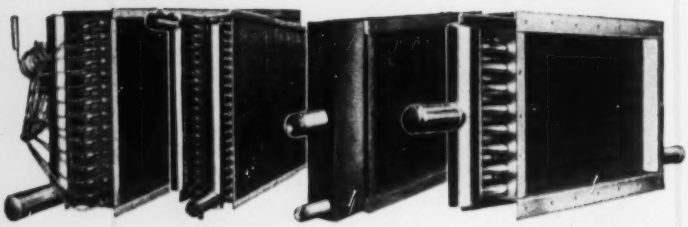
MULTI-ZONE UNITS—Sizes up to 36 sq. ft. Cooling Coil Face Area. Catalog MZ-1.



SPRAYED COIL DEHUMIDIFIERS—56 Sizes. Coil Face Areas to 81 sq. ft. Catalog No. SC-1.

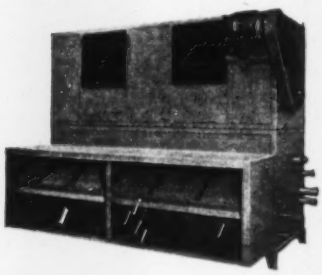


HEATING AND VENTILATING UNITS—Air Volumes 300 to 28,800 CFM. Catalog No. HV-1A.



FINNED COILS—Direct Expansion Coils, Water Coils, Steam Distributing Tube Coils, Standard Steam Coils. Sizes up to 36" wide x 120" long. Catalog No. BC-1.

Write for name of nearest representative and catalogs needed.



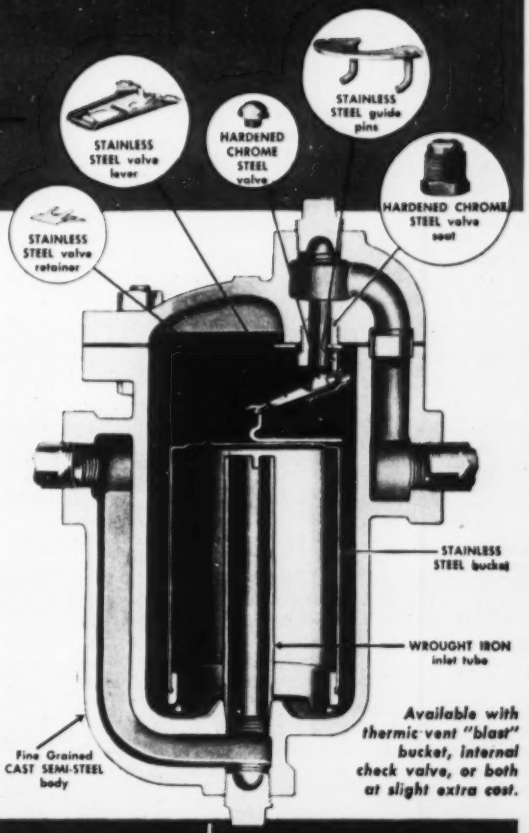
AIR CONDITIONING BLOWER UNITS—13 Sizes. 300 to 21,600 CFM. Horizontal or Vertical. Catalog No. AC-1.

KENNARD CORPORATION • 1817 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

NEW

ARMSTRONG No. 814

. . . a side inlet-side outlet steam trap with 1" or 1¼" pipe connections!


STAINLESS STEEL valve lever
HARDENED CHROME STEEL valve
STAINLESS STEEL guide pins
STAINLESS STEEL valve retainer
HARDENED CHROME STEEL valve seat
STAINLESS STEEL bucket
WROUGHT IRON inlet tube
Fine Grained CAST SEMI-STEEL body

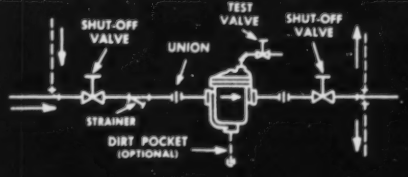
Available with thermic-vent "blast" bucket, internal check valve, or both at slight extra cost.

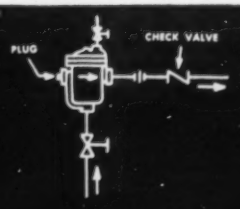
NOW, with the addition of the No. 814, you have a choice of five sizes of Armstrong side inlet-side outlet traps from ½" to 1¼" for use wherever horizontal and opposite pipe connections will make the simplest hookups. Bottom inlet-top outlet traps are available in the same size range, so that for the majority of all condensate loads you can use the body style that best suits the job.

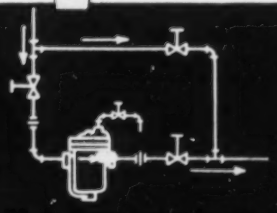
Capacity of the new No. 814 is 6500 lbs./hr. at 125 psig.; height 13⅜"; face to face dimension 8"; weight 45 lbs.; price $46.00 list.

For complete data on the No. 814 and other Armstrong traps, call your Armstrong Representative or mail the coupon today.

ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Mich.







HOW TO ORDER:

Refer to Armstrong Catalog J, Sweets' Plant Engineering or Industrial Construction Files or Chemical Engineering Catalog. Capacities of the 814 are identical to the 214 trap listed in these Catalogs. Other data are given above. Specify trap number, pipe connections and maximum operating pressure.

ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Mich.

- ☐ Send complete data on No. 814 trap.
- ☐ Send Catalog J listing all Armstrong traps.
- ☐ Have Representative call.

Name_____

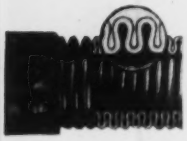
Company_____

Street Address_____

City_____ Zone____ State_____

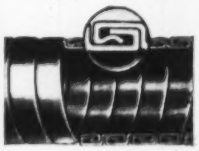
CMH

One dependable source for every flexible metal hose requirement



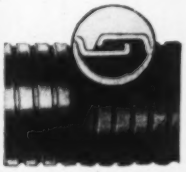
CMH corrugated hose is available with metal braid covering or unbraided in steel, bronze or stainless steel. Used where great flexibility is required at high temperatures and high pressures. Sizes range from 3/16" I.D. to 24" I.D. Depending on size, type and material, it will handle burst pressures to 12,000 psi, temperatures to 1200° F.

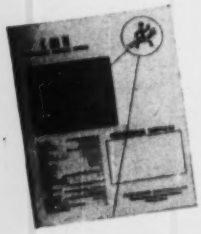
CMH interlocked hose is available in various types, packed and unpacked, in steel, stainless steel, bronze, aluminum, brass and other metals. It is used for steam, exhaust, tar and asphalt, etc. Sizes ½" to 12", I.D. Depending on size, type and material, it may be used for working pressures to 750 psi (constant), temperatures to 600° F.



CMH double groove (ball bearing design) hose is available in bronze, steel or stainless steel with asbestos packing and with or without metal braid covering. Widely used for non-searching liquids and gases at low to moderate pressures and temperatures. Sizes range from 5/32" to 1¼", I.D.

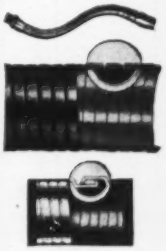
CMH square locked hose is available unpacked or with a choice of several types of packing in steel, bronze, brass, aluminum, stainless steel, etc. It is used as conduit, cable armor, nozzles and many similar applications. Sizes range from 3/16" to 1", I.D. Normally used only at very low pressures.





For full information on all CMH hose products write for Catalog 130 or see the Flexonics catalogs in Sweet's Plant Engineering File, Chemical Engineering Catalog and The Refinery Catalog. For maintenance hose, see the classified pages of your telephone directory for the name of your CMH distributor.

Standard assemblies and special purpose flexible metal hose items are manufactured for such services as steam, tar and asphalt, machine tool coolants, machine tool wiring conduit, dry granular products. We will be pleased to send data on any specific requirement.



CHICAGO METAL HOSE Division

Flexonics *Corporation* 1391 South Third Avenue, Maywood, Illinois

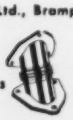
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies CMH products that have served industry for over 50 years.

CMH

Flexible metal hose

Expansion joints



Aircraft components

Metallic bellows and bellows assemblies

See how a good idea grows and grows

Right from the start most heating men recognized that the McDonnell No. 157 was bound to be a success. It offered the favorite of all higher pressure pump controls and cut-offs in a self-contained water column body. It combined proven performance with a new speed and economy of installation.

What you may not realize is how much we have been forced to widen this basic idea. Today there are at least 9 variations of that first No. 157 adapted to offer longer or shorter water columns; different operating levels; different tappings for gauge glass, try cocks and equalizing lines. All can be furnished with either manual or automatic reset.

The drawings show some of these No. 157 models that engineers, boiler manufacturers and contractors have asked for. Whatever you might need just name it and chances are we can pick it right off the shelf.

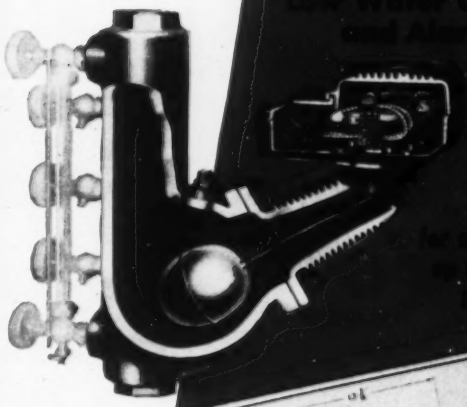
All of these No. 157 models are built around the famed McDonnell No. 150 Pump Control, Low Water Cut-off and Alarm. They represent the one right way to control the boiler feed pump — according to the boiler water itself. They are built from the word go to stand the gaff of high temperature and pressure—with completely packless construction, heavy duty mercury switches, all operating parts up out of the hot zone, porcelain bead insulation and many other refinements.

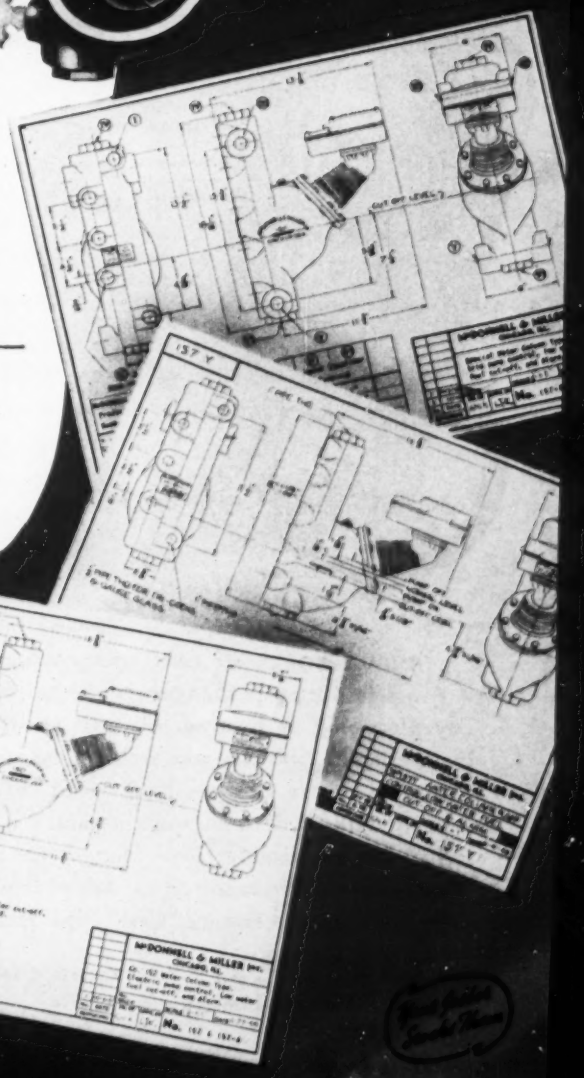
For complete information on the No. 157 models available write for copies of engineering drawings.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

McDONNELL No. 157

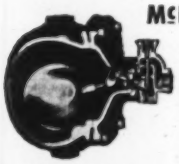
Pump Control, Low Water Cut-off and Alarm



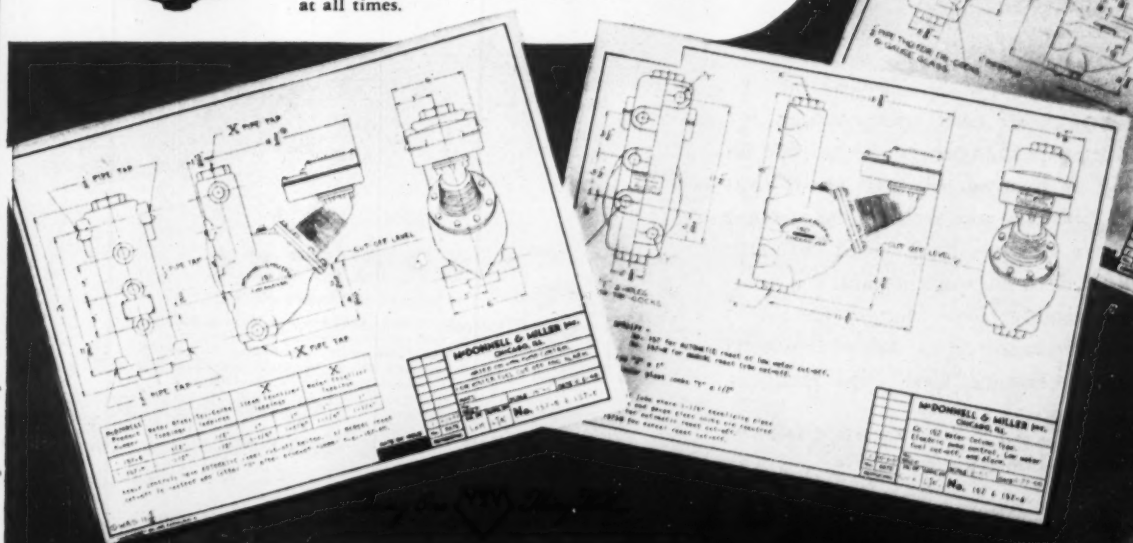


Used with the No. 157 . . .

McDONNELL No. 27 Make-up Water Feeder



The No. 157 starts and stops pump as boiler water rises and falls — keeps the boiler level where it should be for maximum steaming efficiency. An ideal team-mate is the No. 27 Make-up Feeder, which adds water to receiver as needed to assure an adequate minimum supply at all times.



McDONNELL

GRABLER

SQUARE "GEE" PIPE HANGERS

Give relief from time-wasting grief

A DOUBLE CHECK of time cost records for assembling pipe hangers with the pipe on any plumbing or heating job will show that Square "Gee" Pipe Hangers are time-cost saving tools. They are designed and fabricated to comply with modern engineering and construction practices. Grabler Pipe Hanger Catalog J illustrates and lists many types. Ask your wholesaler for Grabler Square "Gee" Pipe Hangers.

THE **GRABLER** MANUFACTURING COMPANY
6565 Broadway, Cleveland 5, Ohio

GRABLER

THE SQUARE "GEE" LINE INCLUDES:

Malleable Fittings, AAR Fittings, Unions, Rail Fittings, Cast Iron Steam Fittings, Cast Iron Drainage Fittings, Patented Drainage Fittings, Copper Tube Solder-Joint Fittings, Cast Brass Solder-Joint Drainage Fittings, Steel Pipe Nipples, Hangers.

WAREHOUSES: New York • Philadelphia • Atlanta • Pittsburgh • New Orleans • Dallas • Chicago • St. Louis • Minneapolis • Denver • San Francisco • Los Angeles

YOU PROFIT BY

Curtis EXPERIENCE

in 15 years

of Packaged Air Conditioning Pioneering

One of the First in the Industry

Curtis units that were installed back in the days when packaged air conditioning was a novelty are still giving faultless service. Today's Curtis packaged units are better than ever . . . perfected by 15 years of experience.

YOU'LL SELL more packaged units when you sell these Curtis advantages:

- Long life, slow speed operation
- Quiet and dependable
- 5 year warranty
- Easy installation
- Attractive, modern appearance
- Complete range of sizes — 2, 3, 5, 7½, 10 and 15 tons

Nationally Advertised in THE SATURDAY EVENING POST, TIME and NEWSWEEK.

For Full Information
MAIL THIS COUPON — WITH YOUR LETTERHEAD

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of Curtis Manufacturing Company (Since 1854)
1950 Kienlen Avenue · St. Louis 20, Mo.

746

CURTIS REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1950 Kienlen Avenue, St. Louis 20, Missouri

I am interested in direct factory franchise. Send complete details.

Company Name .....

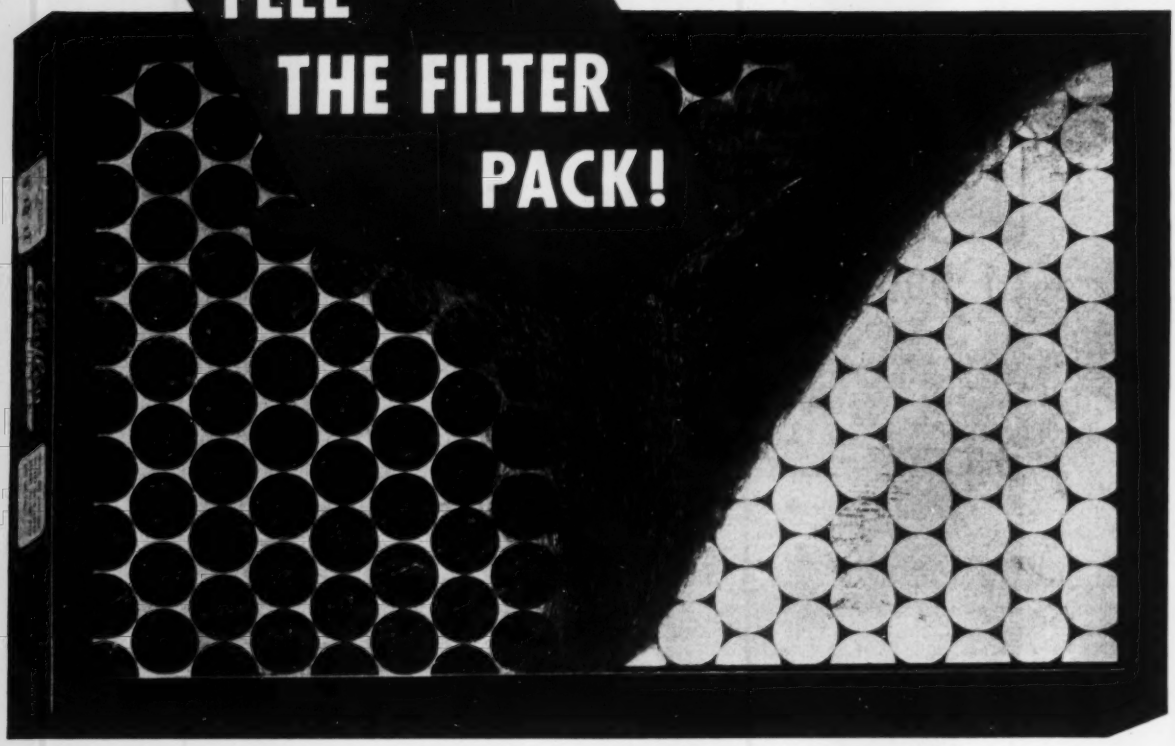
Street .....

City ..... Zone ..... State .....

Signed .....

When you Compare Air Filters . . .

FEEL THE FILTER PACK!



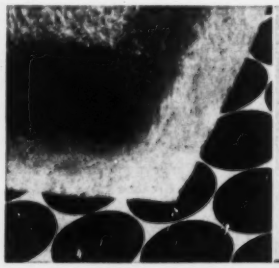
The soft, silky glass fibres are easy on the hands—and really stop Dust! The *magnified* view of the Glasfloss filter pack above shows why the long, fine curly fibres provide efficient filtering action. This fluffy, resilient mass provides an intricate maze of air passages with a greater surface area to catch and hold more dust throughout the entire pack. RESULT: Longer life, less changes, lower cost.

Glasfloss DISPOSABLE AIR FILTERS

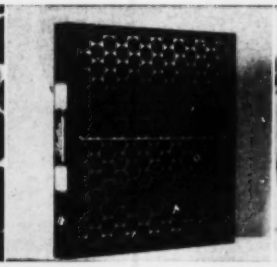
- Hold more dust at higher efficiency
- Less resistance to the passage of air
- Insure greater air capacities
- Easier to handle during installation and removal
- Tough and resilient
- Highly fire resistant
- Moisture-proof

Glasfloss
MAKES A COMPLETE LINE OF DISPOSABLE AIR FILTERS

Descriptive literature on request—
Address Dept. HP-9



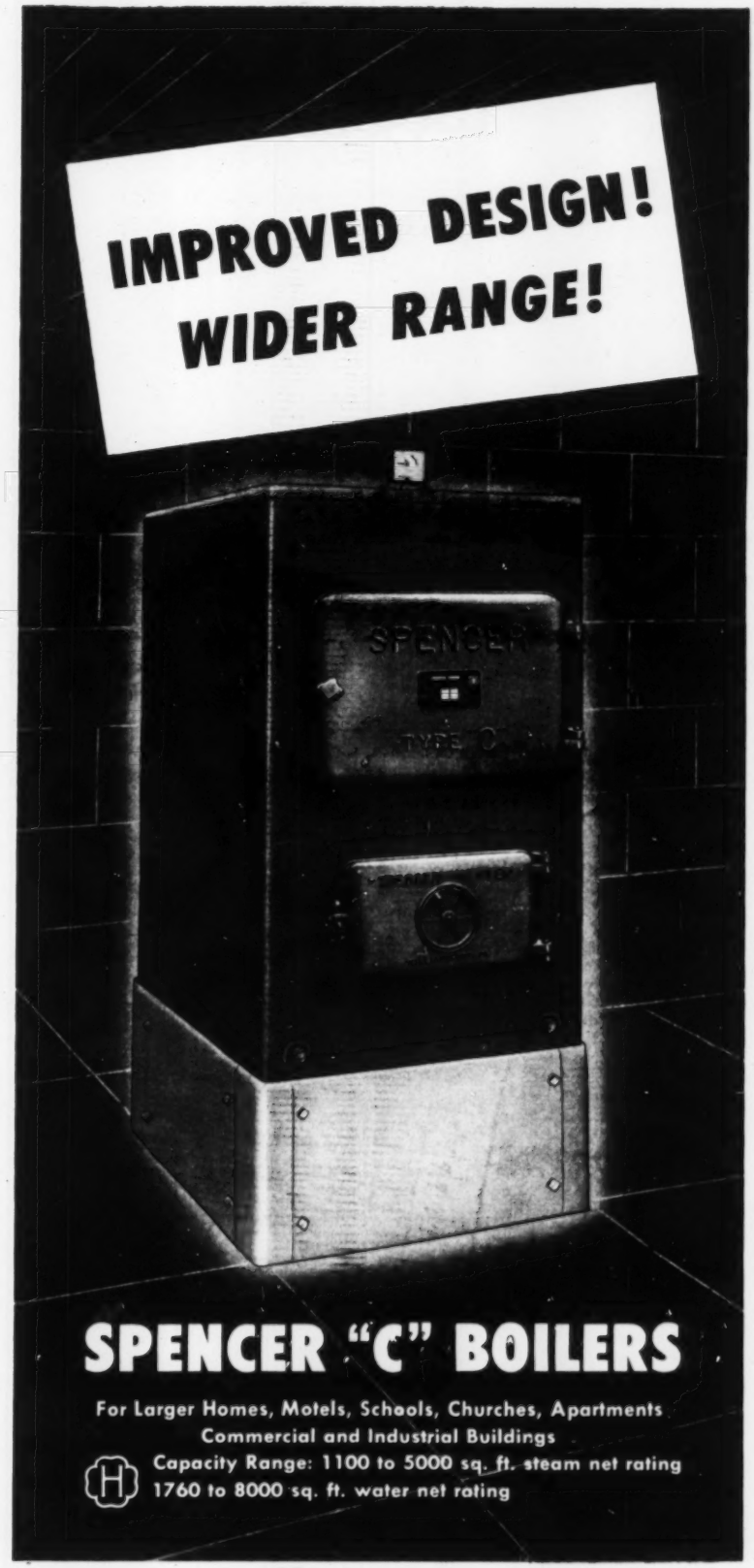
GLASFLOSS I-S
for heavy industrial use



GLASFLOSS STANDARD
the all-purpose filter

GLASFLOSS ROLL-PAK
for economical bulk use

Glasfloss 155 EAST 44th STREET, NEW YORK 17, N. Y.


IMPROVED DESIGN!
WIDER RANGE!
SPENCER
TYPE C
SPENCER "C" BOILERS
For Larger Homes, Motels, Schools, Churches, Apartments
Commercial and Industrial Buildings
Capacity Range: 1100 to 5000 sq. ft. steam net rating
1760 to 8000 sq. ft. water net rating

SPENCER'S

POPULAR "C" BOILERS NOW OFFER NEW FEATURES

. . . NEW SIZES . . .

MORE ATTRACTIVE PRICES!

Now, the most popular series in Spencer's quality line of boilers is available for a wider range of jobs . . . and at more attractive prices.

Improved design now makes this outstanding boiler available with standard 15" base or extra base heights, at nominal charge, for special fuel-burning installations. Four new larger models, with heavy 3" fire tubes, have been added to the line, providing greater range in application.

Here are some of the outstanding features of the Spencer "C" Boilers: water-cooled, precision-ground flue and fire-door frames, equipped with heavy cast-iron insulated doors; extra-heavy steel-plate smokeboxes; staggered boiler tubes for rapid heat transfer; service water-heating coils in many capacities.

Entire boiler line available with attractive standard jackets, insulated with glass wool, with beautiful blue-gray hammerloy finish.

Any fuel can be fired in the Spencer "C" Boilers. Easily and quickly converted from hand to automatic firing.

For any job—residential, industrial or commercial—requiring 1100 to 5000-sq.-ft. net load steam, low pressure, specify one of Spencer's "C" Series. *Save dollars and provide the highest quality heating plant available.*

SPENCER
HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

Spencer Heaters—Dept. HP-93
Lycoming-Spencer Division
AVCO Manufacturing Corp.
Williamsport, Pennsylvania

Dear Sirs:

Please send additional information and specifications on the new Spencer "C" Series Boilers to:

Name_____

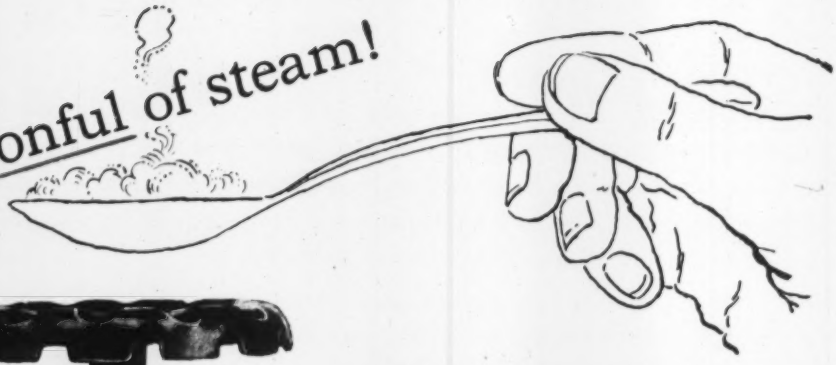
Position_____

Company_____

Address_____

City_____ Zone_____ State_____

a teaspoonful of steam!



HERE'S THE ANSWER
TO YOUR SMALL FLOW
CONTROL PROBLEMS

a NEW LESLIE REDUCING VALVE

for accurate, foolproof regulation of small flows of steam, air, gas or liquids, with inlet pressures to 1000 psi and reduced pressures from 2 to 400 psi.

Change operating conditions quickly and easily with simple, handwheel adjustment —no need to waste time changing springs or swapping parts. Check these widely accepted Leslie features that are standard in the new, efficient, Leslie Small Flow Reducing Valve.

Check these features

- Simple, compact construction
- Top quality materials
- Metal Diaphragm
- Entirely enclosed—no stuffing boxes
- Corrosion resistant springs
- Hardened stainless steel valve
- Interchangeable inner valves

SEND FOR DESCRIPTIVE BULLETIN 511-A
WITH *COMPLETE* CAPACITY TABLES

Before you order—

The new Class LCB is just one of the many units that are *special* with most manufacturers but are *standard* with Leslie.

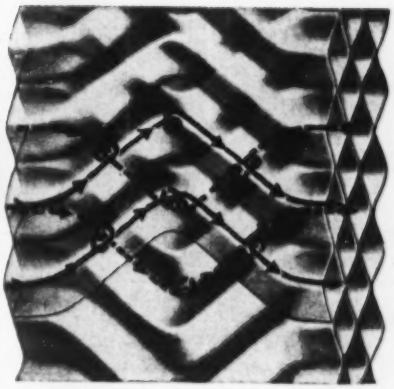
Check to see if any pressure, temperature or level control you want is standard with Leslie, before you order. Play it safe. Your Leslie Engineer is listed under "Valves" or "Regulators" in the classified telephone directory in principal cities.

LESLIE

THE FIRST NAME IN PRESSURE,
TEMPERATURE AND LEVEL CONTROLS
Since 1900

LESLIE CO., 237 Grant Avenue, Lyndhurst, New Jersey

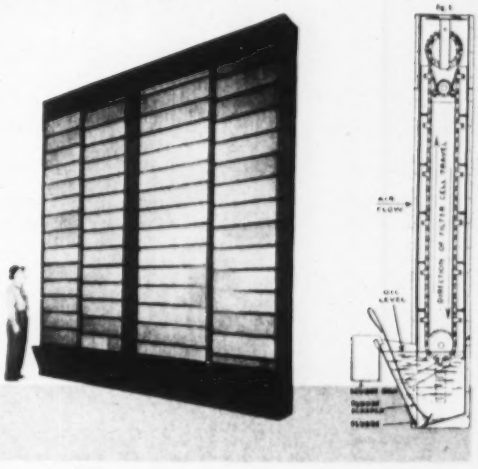
THIS DIAGRAM SHOWS ACTUAL-SIZED DETAIL OF CONTINENTAL



HIGH-EFFICIENCY
LOW-RESISTANCE

MEDIA DESIGN

NON-CLOGGING, metal honey-comb filter media swirls the split air-stream through Continental filters with a surprisingly low resistance to air-flow. Turbulence of criss-crossed streams efficiently extracts dust by viscous impingement method.

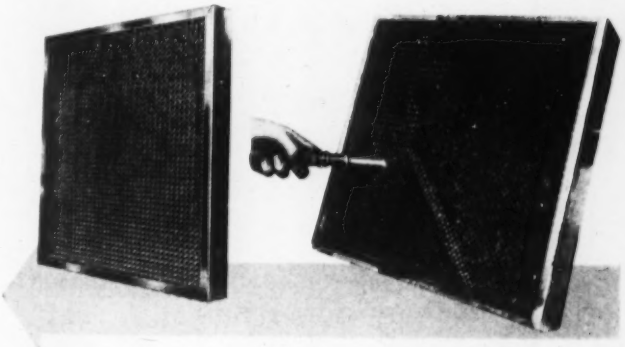


CONTINENTAL
SELF-CLEANING AUTOMATICS

Ferris-wheel type of operation of the multi-celled filter curtain eliminates reversing direction of media in the leaving-air curtain. Thus, no dust can be blown back into the clean-air stream from the leaving air curtain. Patented media design and unique "soak-then-flush" action provide thorough self-cleaning.

CONTINENTAL
E·Z·WASH UNIT FILTERS

Same superior media design provides maximum efficiency with minimum resistance to air-flow in high-velocity reusable unit filters. Called E·Z·WASH because cold water from an ordinary garden hose under normal line pressure is all that is needed for easy, rapid and efficient cleaning. Easily re-oiled with handy E·Z·Oil spray bomb, with any commercial, air-operated oil-spray gun, or by dipping.



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GENTLEMEN: Please send the following:
[ ] New Bulletin No. 401-A
[ ] New Bulletin No. 201-D

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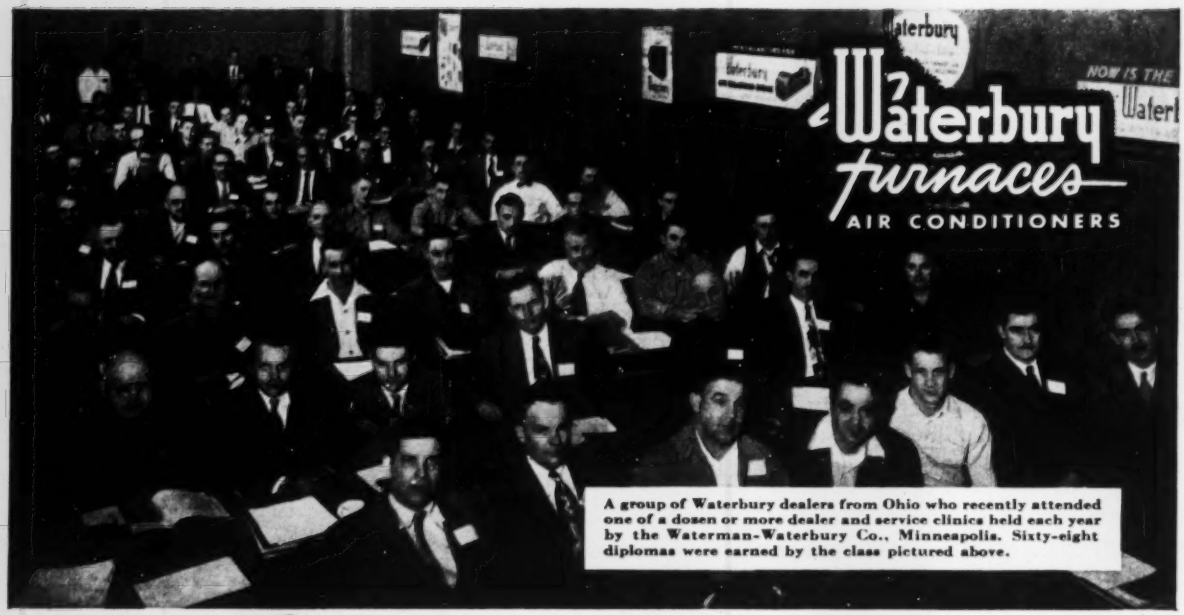
CONTINENTAL

P.O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.



A group of Waterbury dealers from Ohio who recently attended one of a dozen or more dealer and service clinics held each year by the Waterman-Waterbury Co., Minneapolis. Sixty-eight diplomas were earned by the class pictured above.

Dealers Prefer

A FURNACE THAT REQUIRES NO APOLOGIES IN SELLING TO A PUBLIC THAT ACCEPTS NONE

The WATERMAN-WATERBURY Company gives you:

A nationally advertised product.

A sound dealer-distributor-factory policy.

A line for which there is an increasing demand.

YOU give your CUSTOMERS:

Quality workmanship in every unit that leaves the factory, matched by a quality installation.

A casing treated with Bonderite, the corrosion and rust resistant paint base.

A ten year guarantee with each furnace or winter air conditioner.

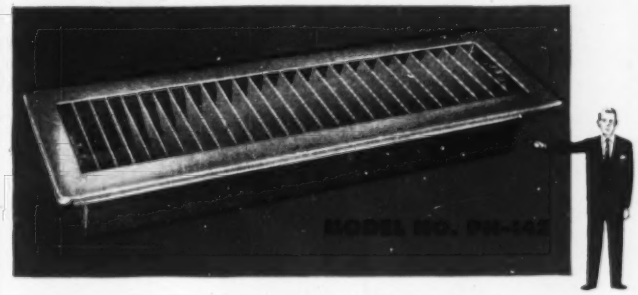
The Waterman-Waterbury Co.

OVER 46 YEARS OF WARM AIR HEATING

1140 JACKSON STREET N. E. • MINNEAPOLIS 13, MINNESOTA

Standard is always first with the finest

here it is...
the floor register everyone wants!



STANDARD'S NEW PERIMETER FLOOR REGISTER

with Standard's exclusive

Dialamatic Control

Standard's new, exclusive dialamatic control gives you POSITIVE HEAT CONTROL. The set screw arrangement means easy balancing, trouble-free operation!

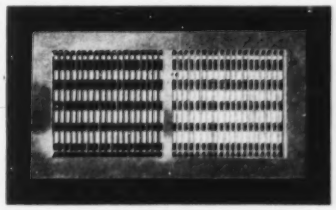
SPECIFICATIONS

The blades of model PH-142 are fabricated of 16 gauge steel, the blades are set in a fixed-fan angle degree for even deflection. The Frame is of one piece, 18 gauge steel construction. The Louvre box fabricated of 16 gauge steel. Packed one to a box, and 20 to a master carton. Comes handsomely finished in gleaming, durable metallic-lustre finish.

Duct opening	Overall of Louvre Box	Overall of Face	Open Area	Depth of Box
2¼" x 14"	2⅛" x 13¾"	3¾" x 15⅜"	80%	2⅛"

THE NEW, IMPROVED *multiple valve* REGISTER

Has Horizontal Multiple Valve Louvres, and 3/16" turned down edge for flush sidewall installation. The attached sponge rubber gaskets are an *extra* feature that prevents escape of air and chipping of wall surface. The Louvres are adjustable so that the flow of air may be directed either downward, straight forward, upward, or to complete shut-off.



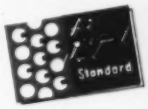
MODEL NO. 331

Metallic Finish standard finish on this style

Write now for Standard's Free Pocket Catalogue

MEMBER NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION — INDOOR COMFORT

write now!



No cost or obligation to you

Gentlemen: Please send me your new pocket catalogue at no cost to me.

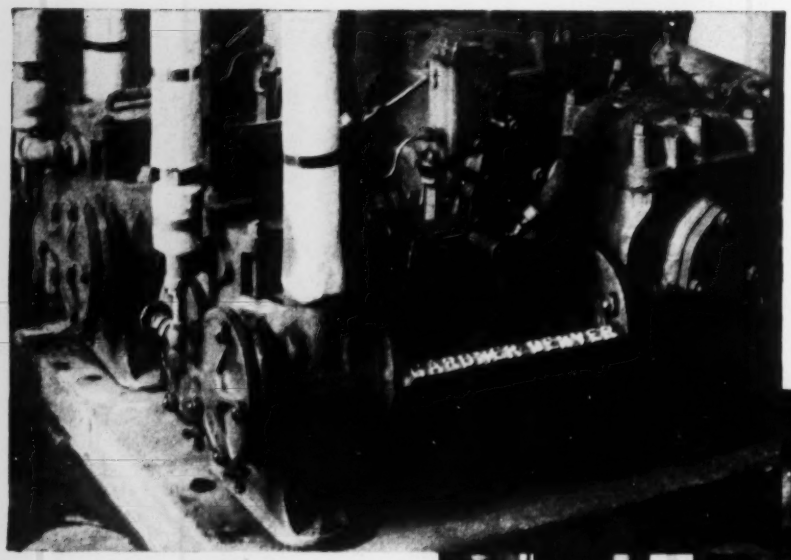
NAME_____

ADDRESS_____ CITY_____ ZONE_____ STATE_____

COMPANY NAME

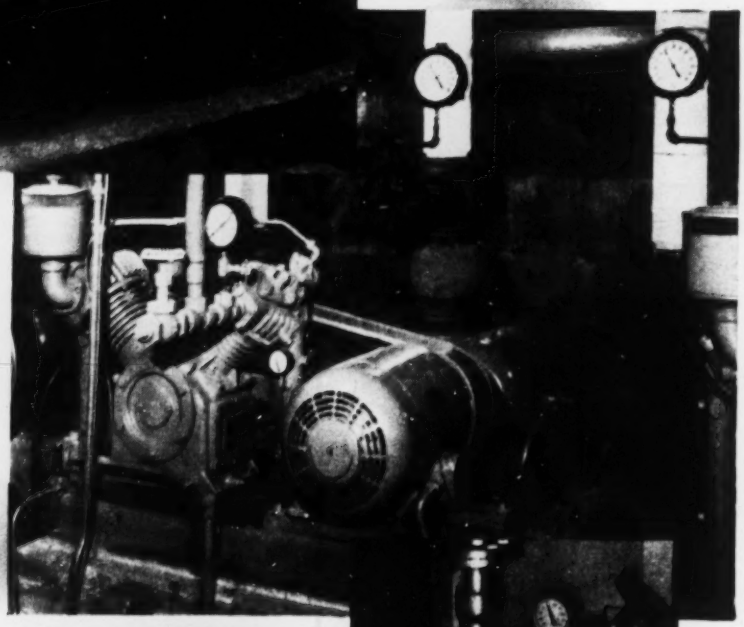
Standard Stamping and Perforating Co.

3151 West 49th Place—Chicago 32, Illinois



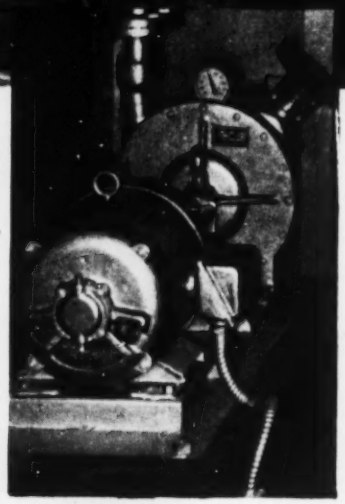
STEAM PUMPS

for boilerfeed, processing and liquid transfer service.



AIR-COOLED COMPRESSORS

for sprinkler systems, soot blowing and general compressed air supply.



CENTRIFUGAL PUMPS

for hot or chill water circulation, water supply and other pumping services.

SINCE 1859

Our 94 years of quality manufacturing experience is your assurance of customer satisfaction on every Gardner Denver product you install. Write for descriptive bulletins.

SINCE 1859

GARDNER-DENVER

Gardner Denver Company, Quincy, Illinois

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

ANOTHER REPORT OF READING COPPER TUBING "ON THE JOB"

NORTH CAROLINA CONTRACTOR HAS

Installed

READING COPPER TUBE

Exclusively Since 1946!

The huge Mallonee Village project, erected in 1951-1952 at Fort Bragg, N. C., consists of 2,000 permanent military housing units plus an ultra-modern, air-conditioned shopping center. For the tested hot water heating system and the hot and cold water lines of the housing units and the air conditioning system of the shopping center, more than a million feet of Reading Copper Tube were installed by Brownlow's, Inc., of Winston-Salem, N. C.

Brownlow's, Inc. is one of the leading mechanical contracting firms in the southeast. Mallonee Village is one of the largest of the many government contracts they have been awarded. *Since 1946, Brownlow's, Inc. has used Reading Copper Tubing exclusively and has installed more than ten million feet during that time!* Among the reasons for his firm's preference for Reading Copper Tube, Mr. R. L. Brownlow, President of Brownlow's, Inc. lists its uniform high quality, precision manufacture, ease of handling and bending, fewer joints and fast, dependable delivery through local distributors.

In One Installation Alone . . .
MALLONEE VILLAGE, FORT BRAGG, N. C.
Brownlow's, Inc. Installed More Than 1,000,000 Feet of Reading Copper Tube!

R. L. BROWNLOW
President

GEO. W. BROWNLOW, JR.
Vice Pres.

O. C. TUCKER
Sec.-Treas.

ARCHITECT:
Seward, Mott & Associates, Washington, D. C.
GENERAL CONTRACTOR:
Loving Weaver, Fort Bragg, N. C.
MECHANICAL CONTRACTOR:
Brownlow's, Inc. Winston-Salem, N. C.

Sold Exclusively Through Plumbing and Heating Supply Wholesalers!

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

READING COPPER TUBING

OFFICES AND EASTERN DISTRIBUTION DEPOT:
36-12 47th Ave., Long Island City, N. Y. • STillwell 6-9200 Works: Reading, Pa.
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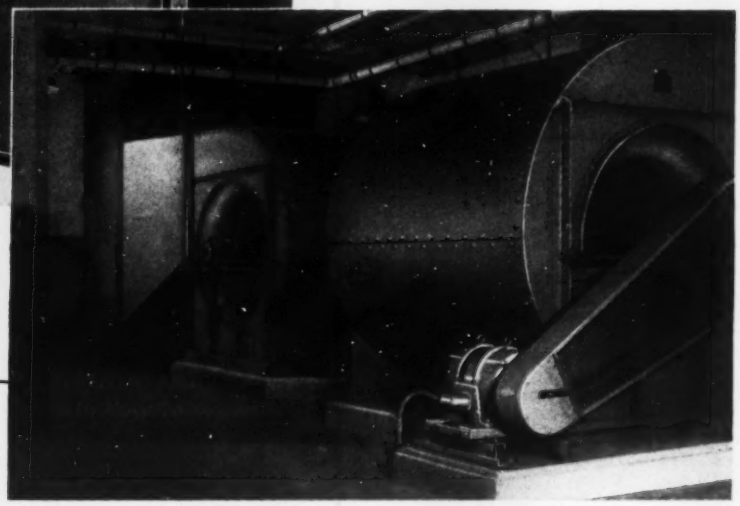
"You Can Just FEEL the Efficiency in this Streamlined Cone!"

Bayley

ENGINEERED

From Drawing Board to Finished Equipment, For Smooth, Quiet Fan Operation . . .



Two No. 445 Type AP-DWDI Supply Fans In Gen. Accts. Office Bldg., Washington, D. C.

Your inquiries will be given the promptest, most thorough attention by our engineering staff. Illustrated literature upon request.

The careful attention given to perfecting all design and construction factors is evident in every style and type of fan or blower in the complete BAYLEY line . . . Result — a consistently high standard of performance and dependable, trouble-free service. This is why foremost system designers, contractors, architects, and owners feel confident in specifying BAYLEY for every class of air-handling requirement.

BAYLEY BLOWER COMPANY

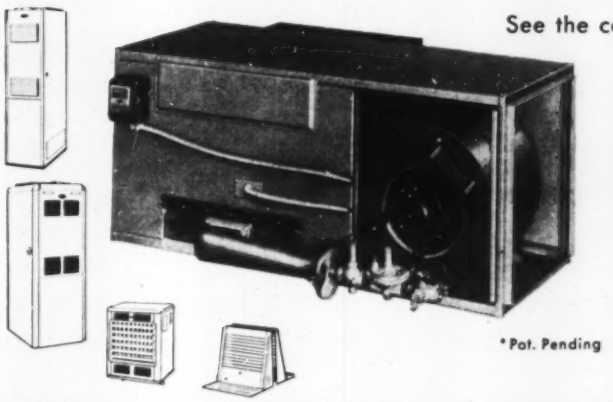
6600 W. BURNHAM ST. MILWAUKEE 14, WIS., U. S. A.

for the Smaller homes

UTILITY'S NEW HORIZONTAL FORCED AIR FURNACES

Here are the ideal forced air furnaces for small home installations. They fit into an attic, under the house or any compact out-of-the-way place to save precious floor space. Easy to install and low in cost, Utility Horizontal Forced Air Furnaces meet competitive conditions on the job.

Equipped with Utility's variable speed Dy-Rekt* Drive Blower these units provide quiet, efficient heating operation because motor shaft and blower wheel shaft are one and the same. No pulleys or belts. Automatic controls, trouble-free operation, fewer service call-backs. For large home heating at small home cost, select Utility Horizontal Forced Air Furnaces. AGA approved.



*Pat. Pending

See the complete UTILITY heating line now

guaranteed heating performance

UTILITY
TRADE MARK

UTILITY APPLIANCE CORP.
4851 S. Alameda St., Los Angeles 58, Calif.

Manufacturers of Gaffers & Sattler and Occidental Automatic Gas Ranges • Utility Automatic Gas Heating Equipment Utility Air Coolers and Blowers

UTILITY APPLIANCE CORP., Dept. HP-9
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Please send me free information on:

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The Plaza
NEW YORK

provide the finest hospitality

Since the first day of October, 1907, the Hotel Plaza in New York has been famous for luxurious hospitality, with a distinctly Continental flavor.

p-k is proud indeed to be part of this famous hostelry, supplying abundant, clean hot water to Plaza patrons day and night.

The Plaza, like 91% of the hundreds of other buildings that make up the New York skyline, has complete **p-k** heat exchange equipment—instantaneous hot water heaters, storage water heaters, and condensate coolers.

You get the finest when you specify **p-k**. Why not write for facts today?

the Patterson-Kelley Co., inc.

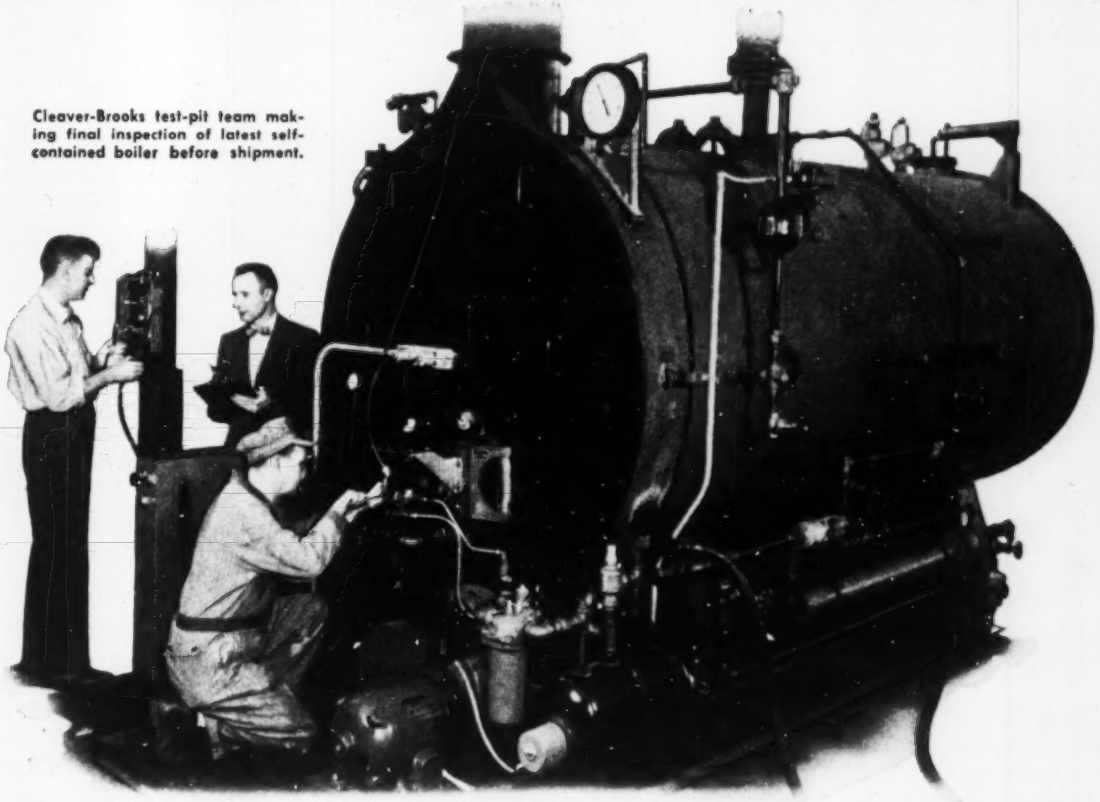
790 Burson Street, East Stroudsburg, Penn.

1950

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

their counterpart

"Test-Pilots" have at Cleaver-Brooks



Cleaver-Brooks test-pit team making final inspection of latest self-contained boiler before shipment.

HIGH SCORES . . . on factory and on-job tests guarantee greatest return from boiler investment

When test pilots give the familiar "O.K." — that's the sign of proven performance. It's the same with boilers in the Cleaver-Brooks plant. Only after accurate, thorough inspection and testing under actual operating conditions do boilers get the final "O.K." from experienced test engineers. That's why you get guaranteed 80% efficiency from your Cleaver-Brooks boiler.

A record of this test is available to every buyer on request. In fact, you as a buyer, consultant, or contractor are invited to witness the actual test on your Cleaver-Brooks boiler before shipment.

And further, Cleaver-Brooks boilers are placed in operation at the job site by factory service engineers who check installation, train your operators and make complete and detailed field tests.

So, when you buy a boiler, insist on factory tests as well as field service tests by qualified engineers. There is no better way of insuring yourself of the very best value money can buy and the greatest return from your boiler investment. Look to Cleaver-Brooks, the leader in the "Packaged" Boiler field for two decades. Write today for latest Catalog AD-100.

Available for oil, gas and combination oil/gas firing.

CLEAVER-BROOKS COMPANY
Dept. K-313 E. Keefe Ave.
Milwaukee 12, Wisconsin, U.S.A.

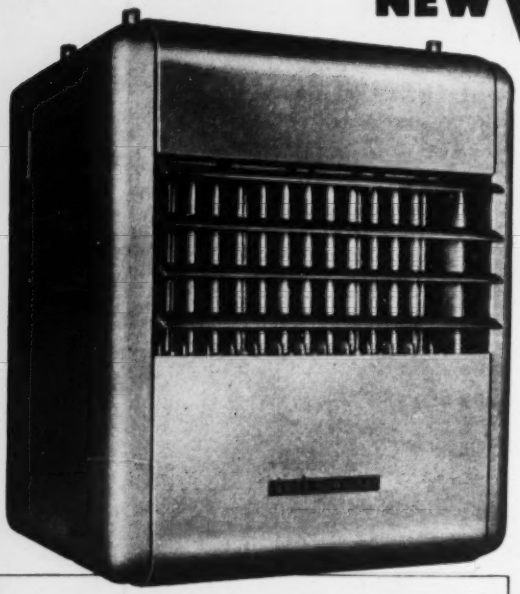
Cleaver-Brooks

Originators of the Self-Contained Boiler

BOILERS — STEAM OR HOT WATER — FOR HEATING AND PROCESSING IN SIZES FROM 15 TO 500 HP, 15 TO 250 PSI

Now Available

NEW Westinghouse GAS-FIRED SPEEDHEATER®



For store, office, factory or warehouse, check these 8 Westinghouse features:

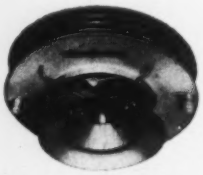
1. Instant on-the-spot HEAT
2. Automatic controls—no attendant needed
3. Ceiling suspension—uses no working space
4. No heat loss as in central plant piping
5. Swift, easy, economical installation; simple upkeep
6. Fully approved safety controls
7. Handsome, functional styling—no finishing cost
8. 7 sizes—25,000 to 200,000 BTU

Heat starts right away—no long warm-up period. Self-contained, ceiling-mounted, the Westinghouse Gas-Fired Speedheater takes no valuable working space, needs no supervision, runs for low cost on natural, manufactured or LP gas. Adjustable louvres control distribution; fan will run separately for air circulation in summer. Get sure heat, save money on installation, avoid work, cut fuel bills—specify the new Westinghouse Gas-Fired Speedheater.

For full details on the Speedheater model best suited for you, call your nearest Westinghouse office for Catalogs 1521 and 1525, or write: Westinghouse Electric Corporation, Air Conditioning Division, Boston 36, Mass.

THE COMPLETE WESTINGHOUSE LINE

Meets Every Unit Heater Need



DOWNBLAST SPEEDHEATER

HORIZONTAL SPEEDHEATER

Get 7 times more output than conventional radiators; save money and space. In addition to the new Gas-Fired units, Westinghouse Speedheaters are available in 82 standard sizes in steam and hot water units. Capacities range from 25,000 to 400,000 BTU in horizontal and vertical models to meet every application.

WESTINGHOUSE AIR CONDITIONING

YOU CAN BE SURE...IF IT'S Westinghouse

J-80335

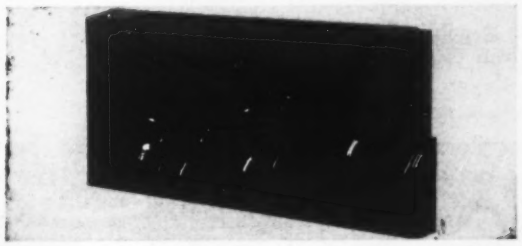
The Jefferson Standard Life Insurance Building would not compromise in its air conditioning!

Consulting Engineers: Watson & Hart
Mechanical Contractors: N. C. & W. H. Sullivan Co., Inc.

The particular system supplied by York for the Jefferson Standard Life Insurance Building in Greensboro, North Carolina, may not be the answer to your project . . . but chances are that York *has* the answer, and here's why:

York *has taken the compromise out* of air conditioning. Your York Engineer is not compelled to suggest that you change a project to fit a system, or force a system to fit the building you are air conditioning. With so wide a range of equipment, York can help you specify the precise installation that will deliver perfect performance at lower initial and operating costs.

There is a York Engineering office in every trading area with experts equipped to work with you from start to finish. A consultation incurs no obligation, of course . . . and can lead to appreciable savings in money, time and worry. Call your York office or write to York Corporation, York, Pennsylvania.



The York Induction Unit System in the Jefferson Standard Life Insurance Building in Greensboro, North Carolina, provides individually controlled climate for office occupants with these trim, modern units. Either heating or cooling supplied from the space saving central station situated in basement of building.

YORK AIR CONDITIONING AND REFRIGERATION
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

EXACTLY THE

Here's your Piping Stockroom YOU NEED...

Your Republic Steel Pipe Distributor carries a full line of steel pipe . . . in all the sizes you need . . . plus the fittings, valves, fixtures, controls, tools . . . everything you need for a complete plumbing, heating, refrigeration, air conditioning, process and industrial piping, or other piping job.

His delivery is fast . . . whether you need a few lengths of pipe or a truckload. Just a phone call will start your order on its way. You'll save time . . . and money. The Republic Pipe Distributor's stockroom becomes yours. You have no capital tied up in stock. You get just the parts you need . . . when you need them . . . and in a hurry. You save floor space. You save insurance. You save handling costs.

Get to know your Republic Steel Pipe Distributor. He stocks high quality materials to give you profitable service.

Easy to bend, thread, and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths

REPUBLIC STEEL

STEEL PIPE

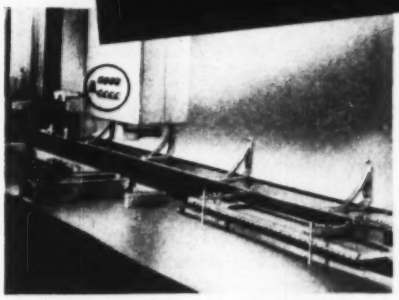
FREEZING EQUIPMENT SALES, INC.'s

Continuous Automatic Package Freezer

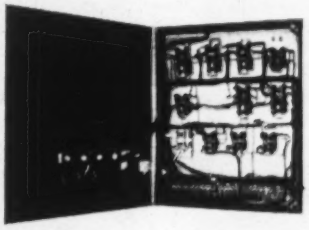
equipped with

ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

The continuous automatic package freezer for fast food freezing, shown above, is designed by the Freezing Equipment Sales, Inc., of York, Pennsylvania. Circles enclose A-B Motor Controls in panel, limit switches, manual switches, and push buttons.



Close-up view of the special control panel showing the Allen-Bradley Bulletin 353 Drum Selector Switch and the eight oiltight control units in the cover.



Interior view of the special control panel showing Allen-Bradley Controls: drum selector switch, oiltight transformer type push button, pilot lights, and selector switches in the cover; ten Bulletin 700 control relays within the cabinet.

Why are Allen-Bradley starters so popular for refrigeration and air-conditioning service? . . . because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick...no jumpers to break. You install them...and forget them!

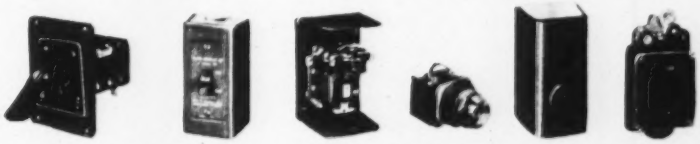
No contact maintenance . . . Allen-Bradley silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

Allen-Bradley Controls Used in This Freezing Unit

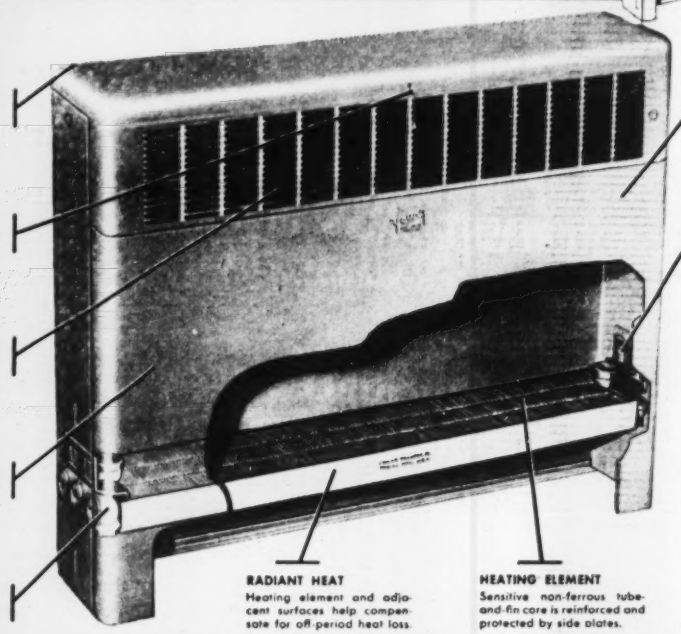


Drum Selector Switch | Manual Switch | Control Relay | Transformer Type Push Button | Push Button | Limit Switch

ALLEN-BRADLEY QUALITY MOTOR CONTROLS

There's More than Meets the Eye in YOUNG CONVECTORS

Take a look inside a Young Convector. Right away, you'll see many "hidden values" in Convector design features and construction quality. Such built-in value places Young Convectors in a class above the ordinary . . . assures easy installation, heating comfort and economy.



AIR SEAL
Strips of felt and/or corner gaskets prevent air leaks and resultant wall streaking.

DAMPER CONTROL
Chain control regulates damper and rate of air flow thru cabinet and heating element.

OVER-SIZE GRILLE
Louvers direct air outward and permit abundant heat delivery . . . greater capacity.

MODERN CABINET
Finished in prime coat . . . can be painted to match decor . . . safe, rounded corners.

SIMPLIFIED PIPING
Cabinet knock-outs and header casting design permit piping from top and bottom.

RADIANT HEAT
Heating element and adjacent surfaces help compensate for off-period heat loss.

HEATING ELEMENT
Sensitive non-ferrous tube-and-fin core is reinforced and protected by side plates.

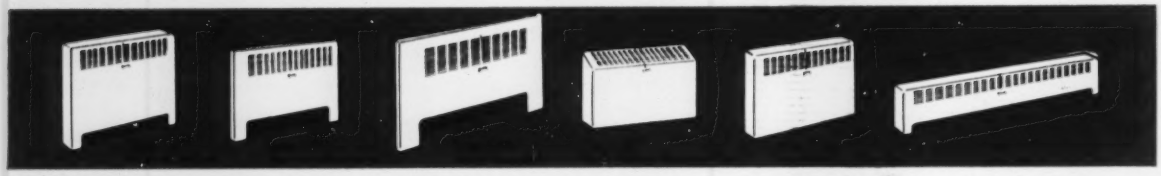
EASY TO CLEAN
One-piece front panel is easily removed for seasonal cleaning.

SIMPLIFIED HEATING ELEMENT SUPPORTS
Provide quick installation and pitching adjustments. Hold heating element securely.

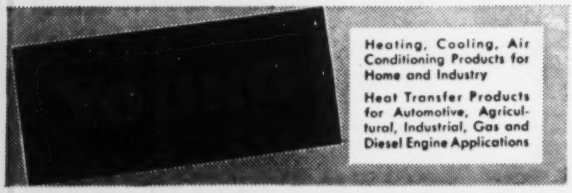
PACKAGED FOR PROTECTION
Reinforced, stapled cartons protect convectors. Marked for easy identification.

STANDARD RATINGS
The ratings of Young Convectors have been determined in conformance with Commercial Standard CS 140-47, as developed cooperatively by the trade and the National Bureau of Standards, U. S. Department of Commerce, and the said ratings have been approved by the Convector Rating Committee.

Whether you specify or install heating equipment, you'll be way ahead with Young Convectors. Only Young offers all the design features shown above. Young supplies Convectors at low initial cost, with six standard types available from stock to meet early delivery dates. Remember, too, every Young Convector has been rated and approved in conformance with Commercial Standard CS140-47. These advantages all add up to greater convenience for you . . . greater satisfaction for your clients or customers. For further details, see nearest Young Representative or write for catalog.



YOUNG RADIATOR COMPANY
Dept. 513-J, Racine, Wisconsin
Plants at Racine, Wisconsin and Mattoon, Illinois
Sales and Engineering Representatives in All Principal Cities


Heating, Cooling, Air Conditioning Products for Home and Industry
Heat Transfer Products for Automotive, Agricultural, Industrial, Gas and Diesel Engine Applications

Leaders in Heat Transfer Engineering for more than 25 years

CONTRACTORS
All Young Convectors are packaged in clearly marked, reinforced cartons for unit protection and ease in identification on the job. Adjustable support (see above) also holds heating element rigidly in place and permits shipping element in cabinet for quicker installation.

OUT OF SIGHT—OUT OF MIND—

Conduit containing 10 pipes in typical installation. Contains no joints, no voids. Z-Crete is as permanent as the earth itself!

Permanently!

...when underground heated piping is insulated

with

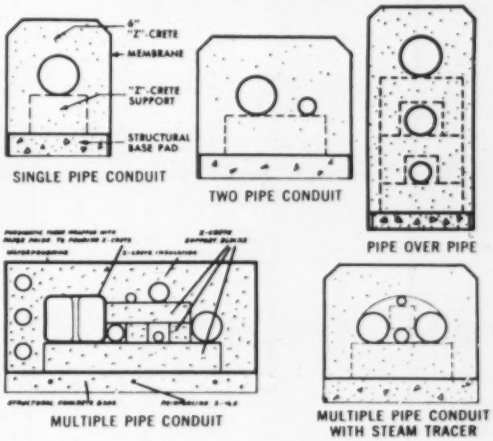
"Z" Z-crete®

Only Z-Crete, the Modern Monolithic Insulation, Makes It Possible to Insulate a Job and Forget It!

Z-Crete, the lightweight, resilient, insulating concrete specially designed for underground heated piping *you can install and forget!* It's as permanent as the earth itself.

Z-Crete's stability and high water resistance make it a good protector against pipe corrosion, as well as an excellent insulator. It is poured directly and monolithically around the piping, eliminating joints or voids. Fireproof, rotproof and verminproof, Z-Crete serves a dual purpose—the insulating concrete is both the structural conduit and the insulation. Any number, size, or arrangement of pipes can be designed into a Z-Crete conduit. Inquire today . . . there's an experienced, licensed applicator near you!

USE Z-CRETE FOR ANY HEATED UNDERGROUND SYSTEM



"Z" Z-crete® DIVISION

ZONOLITE COMPANY

135 South La Salle Street • Chicago 3, Illinois

Z-Crete is furnished and installed only by licensed applicators of Zonolite Company under U. S. Patent No. 2355966—Canadian Patent No. 439356.

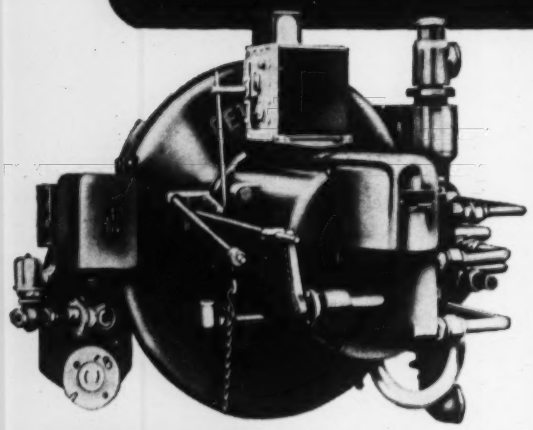
Write for FREE Booklet

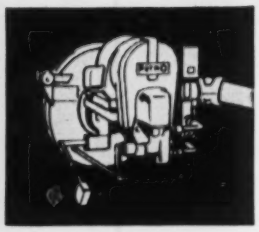
Z-CRETE DIVISION,
ZONOLITE COMPANY
Dept. HP&AC-93
135 S. LaSalle St.,
Chicago 3, Ill.
Please rush FREE Z-Crete Booklet with full details and specifications about this easier, better insulation for underground heated piping.

Name.....
Company.....
Address.....
City.....Zone.....State.....

This contractor knows where he's going!

Petro oil firing





INDUSTRIAL OIL BURNERS

Rotary type. Burn low cost heavy fuel oil with complete reliability. Models for every industrial need. Capacities to 600 b.h.p.

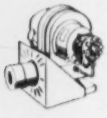
COMBINATION OIL-GAS

The perfect answer to fuel shortages or price advantages. Install in most any boiler. Switch fuels at a moment's notice.

Complete line for Home Heating

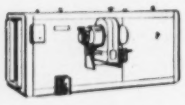
Furnaces and Boilers

Made in popular sizes to fit the heating needs of homes from 4 to 10 rooms. Extremely compact and attractive. Real fuel savers.



Conversion Units

Available for home and commercial use. Give unusual efficiency and fit in most any furnace or boiler. Capacities up to 20 gallons per hr.



Horizontal Furnace

Hang it or hide it—fits anywhere. Available in 5 models from 80,000 to 180,000 Btu's. Install in attic, basement, utility room or crawlway.

HEATING CONTRACTORS CHOOSE PETRO OIL FIRING BECAUSE THEY KNOW IT'S DEPENDABLE

CONFIDENCE — You *know* that a Petro will "do the job." You *know* that a Petro will deliver exceptional fuel economy. You know, and your customers know, that you have installed the best!

EASILY INSTALLED — Petro models are compact and well built. Sound and solid construction, easy access to oil and ignition lines and protected wire connections make Petro a favorite.

SIMPLE, DEPENDABLE PERFORMANCE — Petro oil burners are not complicated by "gadgets." They are simple, dependable units that demand no pampering service.

AUTOMATIC OPERATION WITH FLUCTUATING LOADS — Petro oil burners are almost instantly responsive and are therefore especially efficient for automatic modulated firing.

WRITE FOR COMPLETE INFORMATION **INDUSTRIAL AND COMMERCIAL OIL, GAS AND COMBINATION OIL-GAS BURNERS, RESIDENTIAL OIL BURNERS, OIL AND GAS FURNACES AND BOILERS.**

PETRO

T.M. REG. U. S. PAT. OFF.

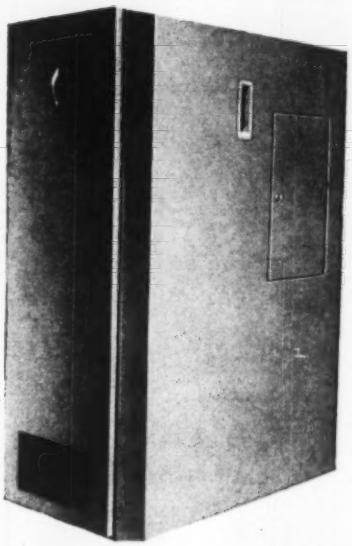
50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING

3189 WEST 106th STREET • CLEVELAND 11, OHIO

IN CANADA: 2231 BLOOR ST., WEST, TORONTO, ONTARIO

NO SALES ARGUMENT TOPS QUALITY...*plus*

THE SOLID COMFORT OF HOT WATER HEATING!



A better sales argument than QUALITY has yet to be invented. Quality speaks for itself, at all times and in all situations. Add to this the obvious advantages of hot water heating over other methods and you have an unbeatable combination of "talking points" that means more sales. These three Burnham Boilers are *quality* throughout . . . *quality* materials, *quality* engineering and *quality* performance!

◂ Burnham PACEMAKER*

Here's the oil-fired boiler that hit the jackpot of popularity because its high quality and fine performance belie its low competitive price. Its double combustion chamber and vertical flue travel over hundreds of heat-grabbing fins, its large direct heating surface make it highly efficient. Built-in all copper tankless water heaters can be supplied for plentiful year 'round domestic hot water. PACEMAKER is made of cast iron for long, trouble-free service; and it's shipped assembled for low cost installation.

Burnham GAS BOILER ▸

PB SERIES

Here's the nearest thing to perfection in a gas boiler – a dual purpose unit designed always to give the best in automatic heating plus economical year 'round domestic hot water with specially designed, all-copper Pendant† and Super† type tankless water heaters. Power burner efficiency – accurate metering of gas and air give perfect combustion. Short refractory tunnel reduces excess air, burns gas completely – result: extra hot "fire-ball" flame.

BURNHAM PRODUCTS WEAR LIKE IRON . . . BECAUSE THEY'RE MADE OF IRON

*Reg. U. S. Pat. Off.
†Patented

Burnham YELLO-JACKET ▸

Here's an all-fuel boiler you'll be proud to sponsor. Its exclusive design and overall efficiency make the heating dollar go farther. Long vertical, lateral and horizontal fire travel, a heat retaining trap, a large combustion chamber and hundreds of heat-grabbing fins are all contributing factors. Plentiful domestic hot water supply. Sturdy cast iron for life-long, trouble-free service.

These three boilers will help you to build the kind of reputation that develops new business. PACEMAKER and YELLO-JACKET are available with flush or extended jackets – Gas Boilers with extended jacket. Mail the handy coupon for complete details including ratings!

Burnham RADIANT HEATING

Burnham Corporation

BOILER DIVISION, IRVINGTON, NEW YORK

FIRST IN THE MANUFACTURE OF BASEBOARD HEATING

I B R

Burnham Corporation HP-93
Irvington, New York

Please send full information and ratings for
☐ Pacemaker ☐ Gas Boiler ☐ Yello-Jacket

Name .....

Address .....

City ..... State .....

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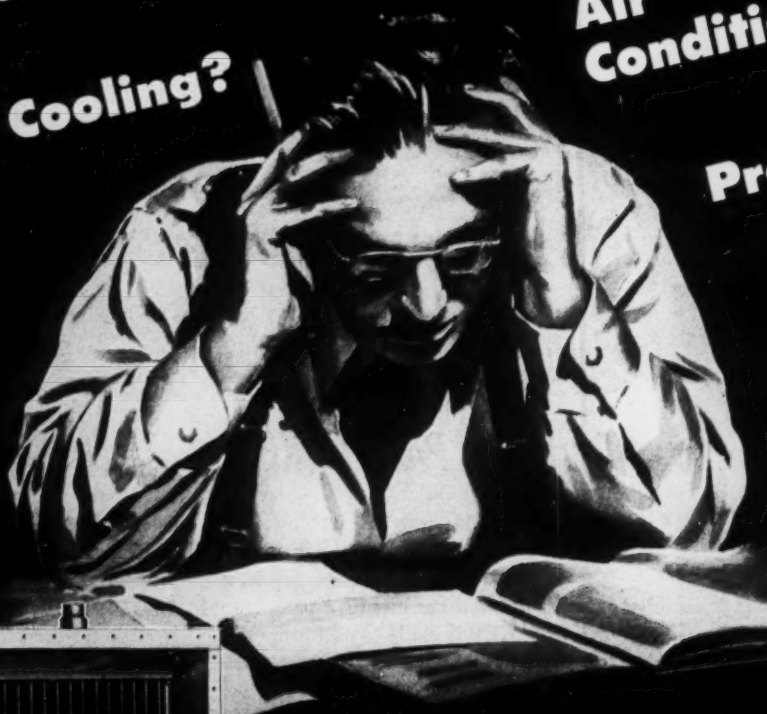
Heating?

Cooling?

Air Conditioning?

Process?



ASK THE AEROFIN MAN

About Practical Heat Exchange

There is a competent Aerofin heat-transfer engineer near you—qualified by intensive training and long experience to find the *right* answer to your own particular heat-exchange problem—and backed by the research and production facilities of the pioneers in light-weight extended surface.

Ask the Aerofin Man.

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

AEROFIN CORPORATION

410 South Geddes St., Syracuse 1, N. Y.

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS

For Continuous Heat Service up to 150 Pounds Steam Pressure

Horizontal Type

Ceiling suspension type with heavy duty welded steel fin-and-tube heating element. The rugged arc-welded construction outperforms and outlasts heating elements made of thinner non-ferrous metals. Avoids their expansion-contraction faults, yet has the same BTU efficiency. Ten basic sizes with capacities from 30 Mbh to 490 Mbh. Totally enclosed motors. (Extra heavy non-ferrous coils also available.)

Vertical Projection Type Also Available

For efficient heating from high-ceiling areas—for door heaters over small openings—or where the horizontal type is not applicable. Ten basic sizes; capacities from 27 to 332 Mbh.

Write for Bulletins

No. 513 Horizontal Type

No. 516 Vertical Type

IUHA HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

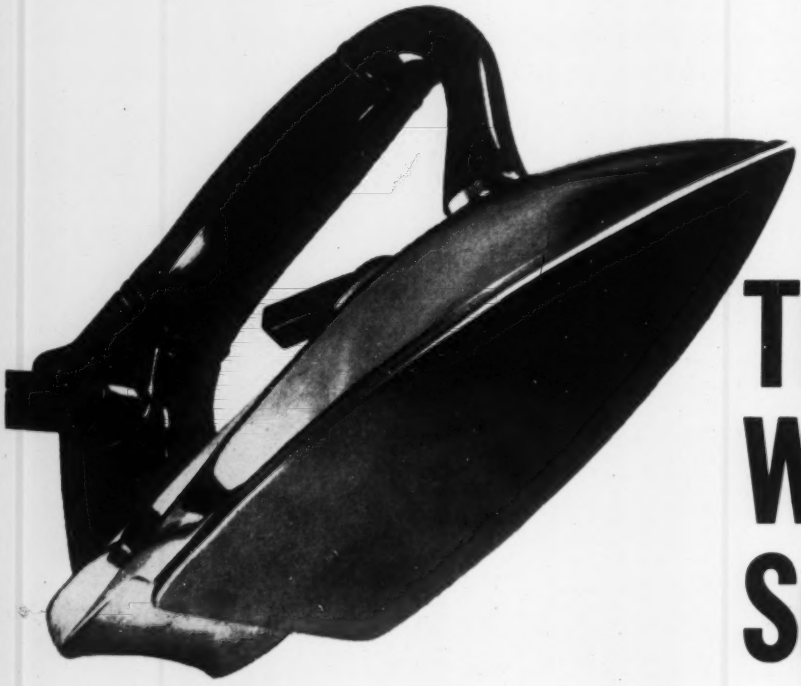
CERTIFIED RATINGS

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 3159 SOUTH SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA



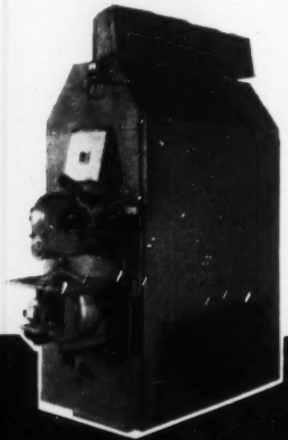
The Working Surface

Should this surface be inadequate it renders the balance of the mechanism, no matter how well it may be designed, of little use. Olson Engineers consider the heat transfer surface the very soul of a heater — Long life and maximum efficiency depend on the amount of heat transfer surface. Olson, through the use of standard 10 gauge, 4" O.D. boiler tubes, gives even more effective heat transfer surface than the highest recommendation of accepted heating authorities.

The fact that Olson Heaters are built rugged for dependable service can not be denied — Write for the detailed step-by-step catalog and you'll know why.

Olson

DIRECT FIRED HEATERS
Gas, Oil, Coal or Dual Gas and Oil



Arthur A. Olson & Company
Canfield, Ohio
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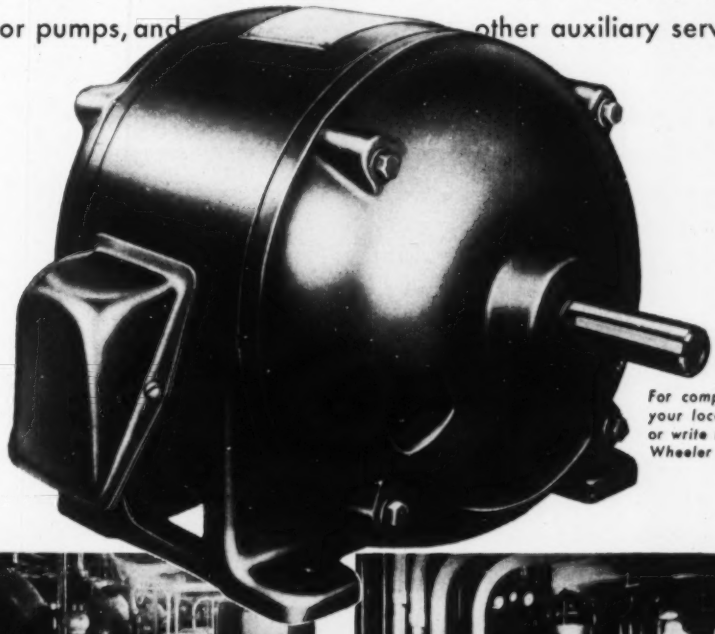
Firm Name .....
City ..... State .....

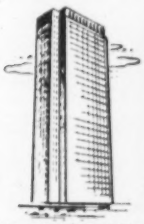
ARTHUR A. OLSON & COMPANY
BROAD ST. · CANFIELD, OHIO

Tops for air conditioning drives!

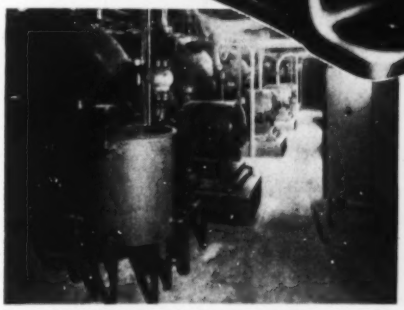
ELLIOTT CROCKER-WHEELER DRIP-PROOF MOTORS have been selected on the basis of reputation and reliability to serve many fine modern, completely air-conditioned buildings of all types. In the same buildings, in addition to air-conditioning drives, Elliott C-W motors are used in large numbers in driving fire pumps, sump pumps, fans, sewage ejector pumps, and other auxiliary service equipment.



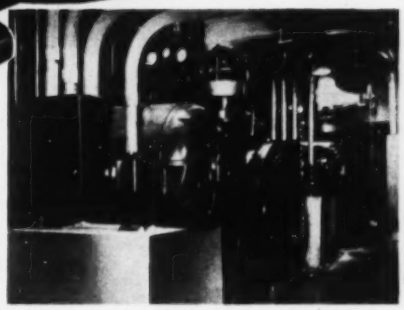
For complete information contact your local Elliott representative or write Elliott Company, Crocker-Wheeler Division, Ampere, N. J.



IN A PITTSBURGH OFFICE BUILDING



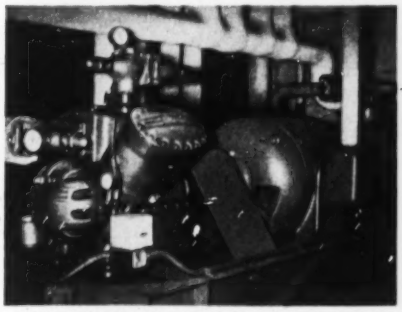
Three Elliott C-W 125-hp motors driving pumps in the refrigeration system.



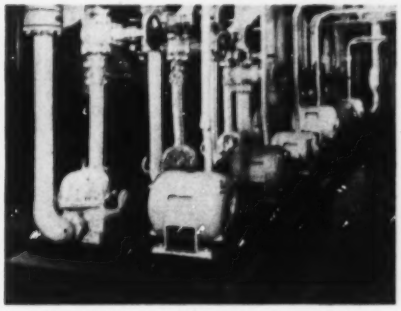
Two of three Elliott C-W 400-hp motors driving freon compressors.

IN A MID-WEST DEPARTMENT STORE

IN A FAMOUS CHICAGO HOTEL



A 40-hp 1800-rpm Elliott C-W motor driving an air conditioning unit.



Seven Elliott C-W motors (50- and 150-hp) driving pumps.

IN A NEW YORK SKYSCRAPER

ELLIOTT Company

W3-7

CROCKER-WHEELER DIVISION

"Combines the Esthetic and the Practical . . ."

THIS description aptly fits both the ultra-modern housing project shown here and the U·S·S NATIONAL Steel Pipe used in its construction.

In the recently completed Armstrong Court in Greenwich, Connecticut, NATIONAL Pipe is used not only in the central forced hot water steam plant which heats the huge project but in decorative hand rails and porch railings to carry out the trim, clean cut, modern appearance of the structure.

For over 60 years, U·S·S NATIONAL has been the standard pipe for conventional hot water and steam heating systems, fire control, and plumbing lines. And today it is the first choice, too, for modern radiant heating and snow melting installations. Long experience, the result of thousands of varied applications, has proved to pipe users that they can put their full confidence in the uniform, dependable, trouble-free performance of NATIONAL Pipe.

Whenever you plan your installation, regardless of the type of service called for, plan on using U·S·S NATIONAL Steel Pipe. Large or small, simple or complex, NATIONAL can fill your every pipe need.

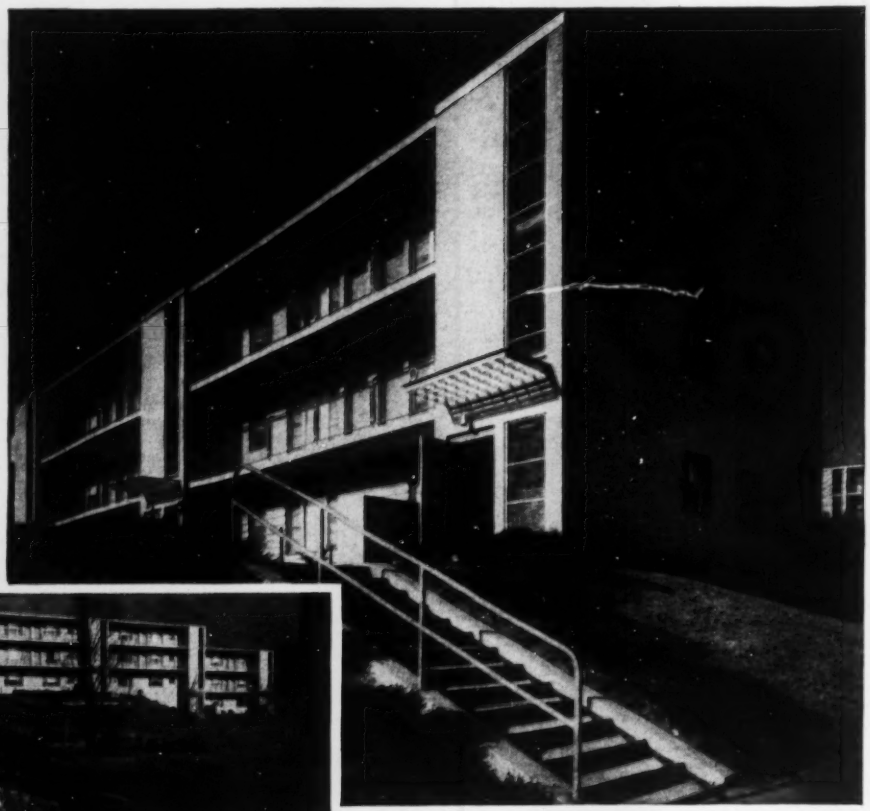
Armstrong Court—Dramatic design in light gray brick.

Architect: Holden, McLaughlin and Associates.

Associate Architect: Joseph G. Weir

General Contractor: Frouge Construction Company

Engineering Firm: Winfield S. Bondy



THE STURDY, HANDSOME NATIONAL PIPE porch railings carry out the modern motif of the three-story structures. These different-level buildings are cleverly disposed on a hilly site to make the most of the relation of the various blocks to green areas.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S NATIONAL Steel PIPE

UNITED STATES STEEL

FOR 90° THREADED CONNECTIONS IN ALL HIGH AND LOW PRESSURE PIPING SYSTEMS . . .

specify and use

BONNEY THREDOLETS

YOU DERIVE THE FOLLOWING ADVANTAGES:

1. ACCELERATED FABRICATION—
with ThredOlets no coupling preparation is necessary—you obtain the most economical type of construction.

2. NEAT AND UNIFORM APPEARANCE—
ThredOlets minimize variations caused by human element—you attain the best engineered type of construction.

3. IMPROVED FLOW—
ThredOlets provide a funnelled inlet—you achieve better performance and better piping system design.

4. DIMENSIONAL STANDARDIZATION—
with each ThredOlet installation, you have constant control of the critical center-of-run-pipe to face-of-outlet dimension.

The Bonney WeldOlet Welding Fittings Catalog, No. W-3, provides complete engineering and dimensional data.
Write for your free copy.

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

715 Meadow Street · Allentown, Pennsylvania

Canadian Representative
Sterling Steel Company, Ltd.
267 Davenport Road • Toronto 1, Canada

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600 Fifth Avenue • New York 20, New York

Once is not enough!

The need for blood is greater than ever, not only for men wounded in combat, but here at home . . . to cure disease, to meet accidents and disasters, and to prepare for civil defense.

Our quota can ONLY be met, if those who give *keep on* giving . . . regularly!

You CAN give more than once . . . as often as every three months with complete personal safety. The more often you give the more often you save a life. For every pint of blood you give goes to someone who needs it desperately.

Remember . . . once is NOT enough. Give blood again and again! Call your Red Cross, Armed Forces or Community Blood Donor Center for an appointment to give blood today.

GIVE BLOOD

...give it again and again

BUSINESS EXECUTIVES!

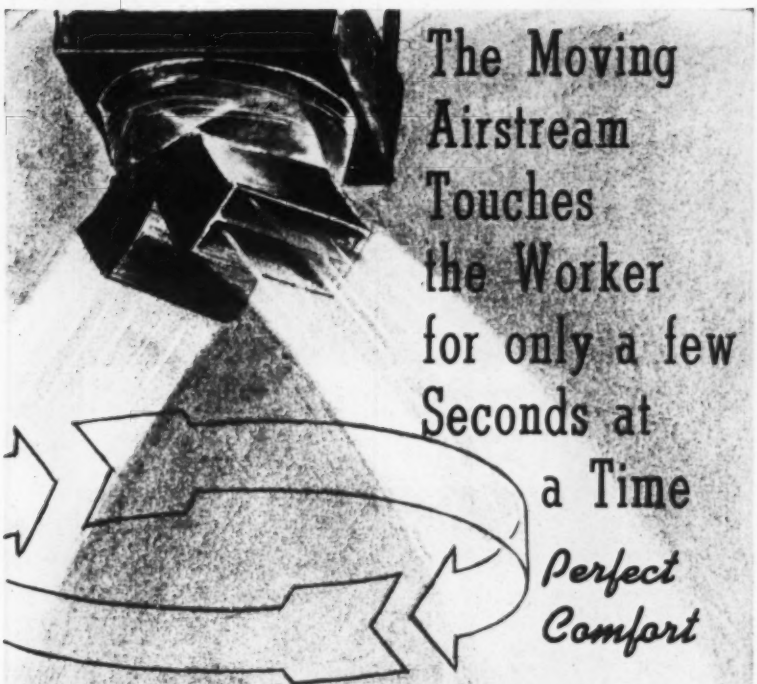
CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ◯ HAVE YOU GIVEN YOUR EMPLOYEES TIME OFF TO MAKE BLOOD DONATIONS?
- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOOD-MOBILE MAKE REGULAR VISITS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLAN BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

Remember, as long as a **single** pint of blood may mean the difference between life and death for **any** American . . . the need for blood is **urgent!**

NATIONAL BLOOD PROGRAM



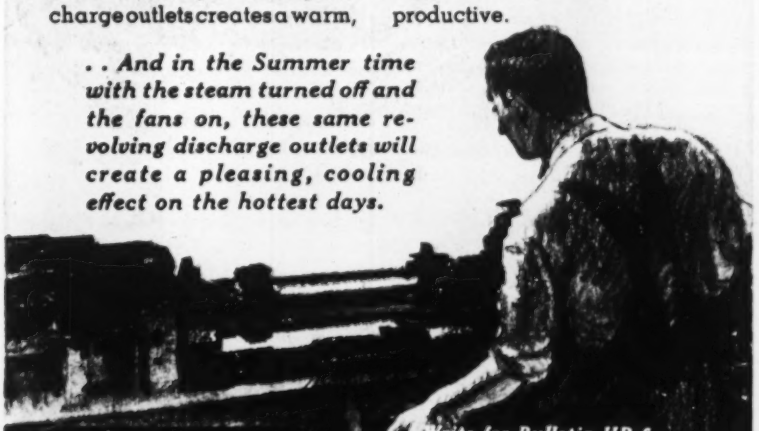
The Moving Airstream Touches the Worker for only a few Seconds at a Time

Perfect Comfort

NO SICKENING HOT BLAST!

THAT is the big difference between most unit heaters and the WING Revolving Heater. The soft airstream from the slowly revolving discharge outlets creates a warm, gentle, yet live sensation of comfortable well-being that is without equal for keeping workers contented and productive.

. . And in the Summer time with the steam turned off and the fans on, these same revolving discharge outlets will create a pleasing, cooling effect on the hottest days.



Write for Bulletin HR-6

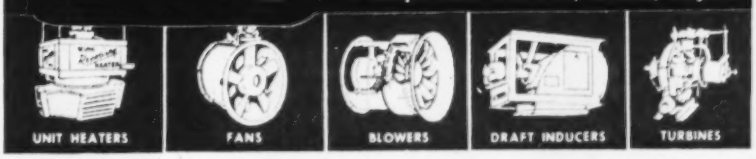
Wing

L. J. Wing Mfg. Co.

140 Vreeland Mills Rd., Linden, N. J.

Factories: Linden, N. J. & Montreal, Can.

In Europe: Etab. WANSON, Brussels, Belgium



MOTORIZED CHIMNEY DRAFT

with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

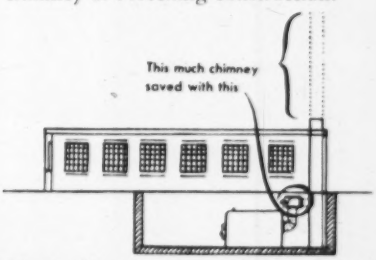
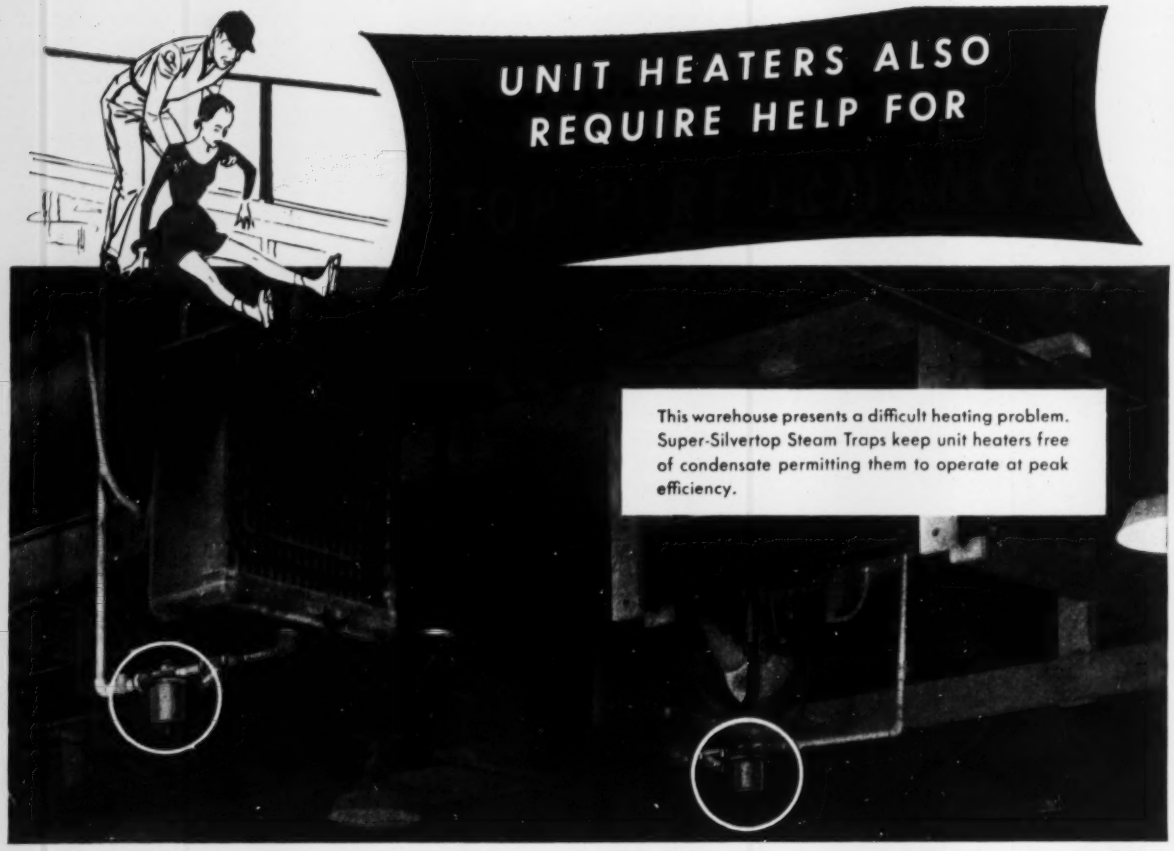


Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.


UNIT HEATERS ALSO
REQUIRE HELP FOR
This warehouse presents a difficult heating problem. Super-Silvertop Steam Traps keep unit heaters free of condensate permitting them to operate at peak efficiency.

INSTALL SUPER-SILVERTOP STEAM TRAPS NOW!

Unit heater inefficiencies can't always be blamed on the heater itself. Heaters need help in order to operate at top performance. The faster the heater is freed of air, when turned on, the quicker it is brought to maximum temperature. And by draining condensate out of the core of the steam compartment at all times, the heater continues to operate at peak efficiency delivering heat at its maximum output. Super-Silvertops succeed where other traps fail because they are activated by water only, regardless of temperature.

Presence of water causes the trap to discharge immediately, preventing corrosion by removing gases and condensate. Help your unit heaters to operate effectively. Install Super-Silvertops now.

To select the proper size trap for unit heaters of various capacities, send for a free copy of "Solving Steam Trap Problems" today. Write

THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland 2, Ohio

FREE STEAM TRAP DATA BOOK

This 36 page book contains complete data on the selection of proper size traps for unit heaters.

THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland 2, Ohio

Gentlemen: Please send without obligation a copy of "Solving Steam Trap Problems".

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

In Canada: Bawden Industries, Ltd., Toronto

SUPER-SILVERTOPS SAVE MONEY

Send for This Useful Reprint Volume

"CORRECT PRACTICE *in* INDUSTRIAL PIPING"

— All-New Second Edition —

196 Pages — 8½" x 11" — $1.50

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

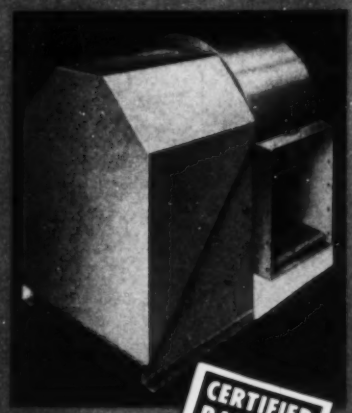
Send $1.50 today for this book to the address below.

KEENEY

PUBLISHING COMPANY

6 North Michigan Ave. Chicago 2, Illinois

ALADDIN UTILITY SETS



COMPACT

TEN SIZES

BELT DRIVEN

SELF CONTAINED

QUIET OPERATING

ALADDIN Belt-Driven Utility Sets are extremely quiet in operation. Designed for general ventilation, they occupy a minimum of space, handling large volumes of air at low noise levels. They are ruggedly built and are ideally suited for roof installation . . . when furnished with weatherproof cover they require no further protection against the weather.

ALADDIN Utility Sets are available with both forward curved or backwardly inclined blade wheels.

Write for complete data

ALADDIN HEATING CORPORATION

2272 SAN PABLO AVE., OAKLAND 12, CALIFORNIA

REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

JENKINS PRACTICAL PIPING LAYOUTS

68

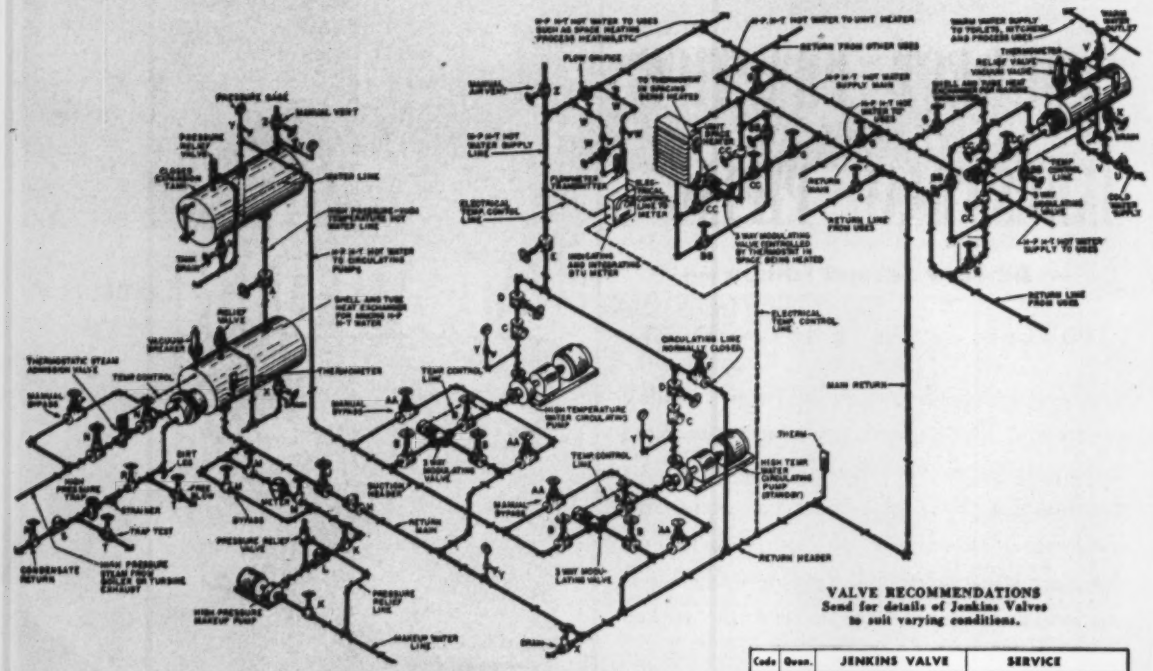


Diagram by Huxley Madeheim, Consulting Engineer
COPYRIGHT, 1953 — JENKINS BROS.

How to plan a HIGH PRESSURE-HIGH TEMPERATURE HOT WATER PIPING SYSTEM

For efficient space and water heating — and for numerous processing needs as well — a high pressure-high temperature system offers several distinct advantages over a steam system.

Often operated at pressures up to 215 psi, with a corresponding temperature of 388°F, a HP-HT system of this type eliminates the need for pitch, drainage, or traps and provides a greater amount of heat transmission for a given pipe size. Moreover, it requires no feed-water treatment and, when used for processing services, eliminates large pressure drops due to sudden load conditions.

The hot water is generated in a shell and tube heat exchanger by means of high pressure steam from either turbine extraction or exhaust. Unit heaters on the HP-HT lines provide for space heating requirements and a shell and tube heat exchanger supplies warm water for lavatories, kitchens, and processing which requires moderate temperatures. When used with accumulators, this system eliminates the need for taking additional steam directly from the steam generating source and, thus, provides a better plant heat balance.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 68.

VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions.

Code	Quan.	JENKINS VALVE	SERVICE
A	1	Fig. 204 188M Gate	HP-HT Hot Water Shutoff
B	6	Fig. 204 188M Gate	3 Way Valve Shutoff
C	2	Fig. 339-R 188M Swing Check	Prevent Backflow
D	2	Fig. 204 188M Gate	Pump Discharge Shutoff
E	1	Fig. 204 188M Gate	Supply Line Shutoff
F	1	Fig. 923 188M Globe	Circulating Line Shutoff
G	6	Fig. 280 Bronze Gate	Branch Shutoffs
H	1	Fig. 339-R 188M Swing Check	Prevent Backflow
J	1	Fig. 204 188M Gate	Return Main Shutoff
K	2	Fig. 280-U Bronze Gate	Makeup Pump Shutoff
L	1	Fig. 962 Bronze Swing Check	Prevent Backflow
M	3	Fig. 280 Bronze Gate	Makeup Meter Shutoff
N	2	Fig. 1010 Cast Steel Gate	Thermostatic Valve Shutoff
P	1	Fig. 1042 Cast Steel Globe	ThermostaticValveBypass
R	2	Fig. 280-UN Bronze Gate	Condensate Line Shutoff
S	1	Fig. 962 Bronze Swing Check	Prevent Condensate Backflow
T	2	Fig. 976-A Bronze Globe	Trap Test, Free Blow
U	1	Fig. 352 Bronze Swing Check	Prevent Backflow
V	2	Fig. 47-U Bronze Gate	Cold Water Shutoff
W	4	Fig. 703 Bronze Globe	Flow Meter Pressure Taps
X	4	Fig. 976-A Bronze Globe	Drain Lines
Y	5	Fig. 703 Bronze Globe	Pressure Gage Control
Z	2	Fig. 976-A Bronze Globe	Air Vents
AA	4	Fig. 923 188M Globe	3 Way Valve Bypass
BB	4	Fig. 976-A Bronze Globe	3 Way Valve Bypass
CC	6	Fig. 280 Bronze Gate	3 Way Valve Shutoff

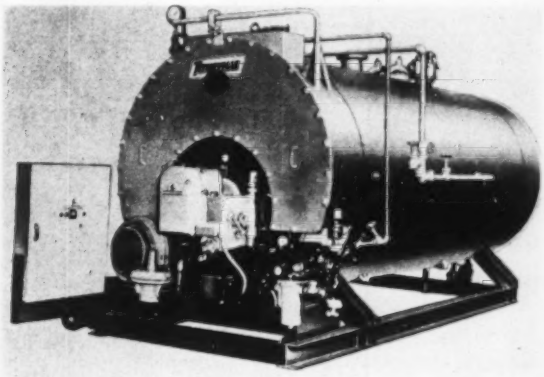
JENKINS VALVES
TRADE JENKINS MARK
Jenkins Bros

EQUIPMENT DEVELOPMENTS . . .

Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Pressurized Boiler-Burner Unit

*Pressurized boiler-burner unit for high or low pressure heating, power and process steam. . . . Sold as a packaged unit, the boiler was designed by Titusville Iron Works Co., and the Iron Fireman Mfg. Co. designed the burner system. The unit operates on oil, gas or oil and gas combination. The boiler has a large furnace volume to provide lower heat release. The tubes are arranged in staggered rows so that release of steam from tube walls is speeded by a wiping action which, the manufacturer states, increases efficiency of heat

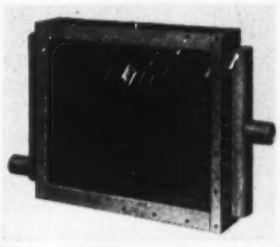


transfer. The automatically controlled burner has a turndown of 5 to 1 and is designed to operate at more than 80 percent efficiency. A volumetric oil control meters by volume the quantity of oil needed for varying loads. The entire boiler-burner unit is sealed for operation at higher than atmospheric pressure. No induced draft fan or natural draft stack is required.

Manufacturers—Titusville Iron Works Co., Titusville, Pa., and Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland 11.

Heating Coils

*New line of heating coils incorporating improved heat transfer surface and structural design. . . . Type "S" is designed for steam or hot water service; Type "HD", heavy duty, for severe industrial applica-

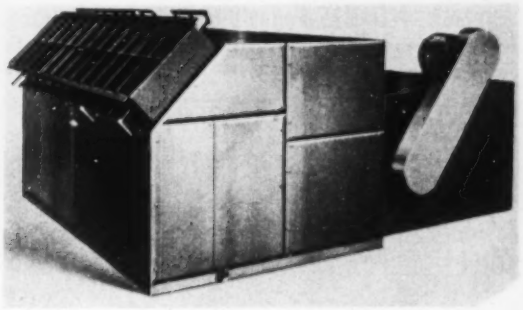


tions; and Type "SD" steam distributing coil, for steam systems when system performance is regulated by modulating the steam supply to the coils. The tubes are mechanically expanded into a fin collar to form a double walled, continuous metal surface. Cross-angles are welded to the tube support and coil casing to provide reinforcement for the entire coil structure.

Manufacturer—Young Radiator Co., 709 S. Marquette St., Racine, Wis.

Multi-Zone Air Conditioners

Multi-zone air conditioners designed to provide both cooling and heating from a single unit to a number of separate conditioned areas, each with individual temperature control. . . . The equipment, known as Type "B", serves up to 12 to 16 separate zones and ranges in capacity from 7,500 to 18,000 cfm. It is of sectional construction consisting of filter, blower, heating



coil, cooling coil and multiple zone mixing damper sections. In operation, air leaves the fan discharge and passes from the cooling and/or heating coil to the multiple zone damper section from which it is discharged through as many separate air streams as required for the individual zones. The mixing dampers for each zone operate independently.

Manufacturer—United States Air Conditioning Corp., 3300 Como Ave., S.E., Minneapolis 14, Minn.

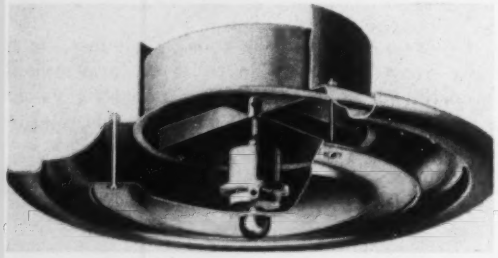
Water Conditioning Products

Three water conditioning products designed to help maintain the efficiency of water cooling equipment in air conditioning systems . . . . "Vapco Preventive" inactivates the solids found in water and is designed to hold them in solution to be drained off rather than be deposited on metal surfaces of the equipment. "Vapco Slime-X" is used to kill slime bacteria and algae growth. It is an organic chlorinated phenol which has been activated by incorporating a penetrant and an interface contacting agent. "Vapco Cleaner" is an acid type salt designed to remove scale and other incrustants. According to the manufacturer, all products may be used while the air conditioning system is in operation.

Manufacturer—Garman Co., Inc., St. Louis, Mo.

Thermostat Controlled Air Diffuser

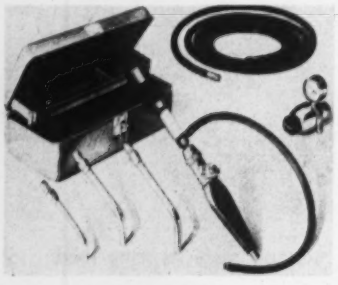
"Kno-Draft" ceiling diffuser for air conditioning systems serving zones having variable heat loads. . . . A pneumatic motor, remotely controlled by a thermostat, regulates the movement of the damper and air volume at the point of discharge. The damper position performance of the air diffuser is unaffected regardless of damper position. The sleeve damper moves up and down without enlarging or constricting the neck area.



Manufacturer—Connor Engineering Corp., Danbury, Conn.

Refrigerant Leak Detector and Repair Kit

"Prest-O-Lite Refrigeration and Air Conditioning Outfit" contains equipment for leak detection and the heating and brazing of refrigeration and air conditioning systems. . . . Included is a "Halide" leak detector stem for the detection of refrigerant gas leaks. Three torch stems are included for open-flame soldering, heating and bending of refrigeration equipment. The stems fit interchangeably into the No. 401 precision handle. In addition, there is an acetylene regulator and a 12½ ft length of acetylene supply hose.



Manufacturer—Linde Air Products Co., Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17.

Vertical Delivery Unit Heaters

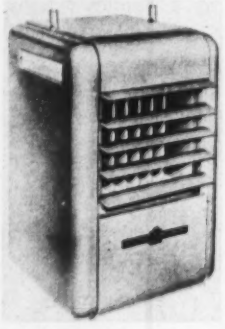
New and improved line of vertical delivery unit heaters for steam and hot water. . . . One of the features of the heaters is light weight, which is said to eliminate the need for structural ceiling supports. The manufacturer states that performance has been improved by increased heat transfer capacity. Outlet air temperatures have been retained in the 110-120 F range. Another new feature is the use of circular casings and coils. The new line is being offered in 26 different models, 13 for normal steam pressures and 13 with lower outlet temperatures for high pressure steam.

Manufacturer—Modine Mfg. Co., 1509 De Koven Ave., Racine, Wis.

Charging Lines for Refrigerants

Reusable quick couplers for making "Freon" and methyl chloride charging lines on the spot. . . . Mounting the couplers on any length of hose is done in three steps. First, the nut is threaded on the hose, then the shell is threaded onto the nut, and then the two are tightened with the aid of an end wrench and vise.

Manufacturer—Resistoflex Corp., Belleville 9, N.J.



Above: Coupler

Left: Heater

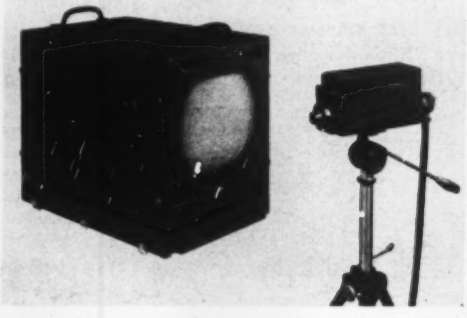
Gas Fired Unit Heaters

Seven sizes of gas fired unit heaters added to the "Herman Nelson" line of steam and hot water unit heaters. . . . The new heaters are said to be suitable for use on all types of natural, manufactured and liquefied petroleum gases. Heat output ranges from 20,000 to 160,000 Btu per hr, with fan diameters from 12 to 20 in.

Manufacturer—American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky.

Industrial Television

Television equipment provides a means of viewing operation otherwise inaccessible. . . .Consisting of a two-unit chain, the picture is picked up by a small, lightweight camera and is transmitted by a single cable to the control monitor's 10-in. viewing screen. The chain is operated from a 115 volt, a 60 cycle power supply is completely self-contained. The camera is remotely con-



The Barrier That Keeps Out Elephants Will Let In Flies

Vapor and condensation insulation is needed in buildings as well as thermal insulation. Inadequate thermal insulation means loss of comfort, larger fuel bills, unnecessarily costly heating or air-conditioning plants. Condensation promoted by faulty vapor insulation can cause structural damage—rotting timbers, peeling paint, crumbling plaster, deteriorating masonry.

Water at 32°F has 205,000 times the density of water vapor, which is a gas. Many non-metallic "vapor barriers" are good waterproofing materials, but water vapor can flow through. The thick aluminum sheets used in multiple accordion aluminum are impervious to vapor.

Multiple accordion aluminum creates an "insulating blanket" of layers of air, fiber and aluminum. Of all heat transferred through structural spaces, 50% to 80% is by Radiation; all but 5% to 7% of the rest is Convection. Multiple accordion aluminum has a reflectivity of 97% for Radiation or radiant heat, and blocks outer and inner Convection. Its slight mass, with alternating layers of entrapped air, minimizes Conduction.

It is practically non-condensation forming. It does not sustain nor retain fortuitous moisture, which gradually flows out in the form of vapor through the usual exterior walls and roofs, which are much more permeable than this insulation.

There is now a new standard Infra Insulation (the commercial form of multiple accordion aluminum) improved to form a "blanket" of **uniform** depth between studs and joists which completely covers the spaces between.

Samples of the new Infra Insulation and a copy of Schwartz's "Simplified Physics of Vapor and Thermal Insulation" sent on request.

COST OF THE NEW* INFRA INSULATION INSTALLED
in new construction between wood joists, material with labor,

Type 6-S: under 9½¢ sq. ft.
Type 4-S: under 7½¢ sq. ft.
Type 4-S Jr. under 7½¢ sq. ft.
*Patent applied for

INFRA INSULATION, INC.
525 Broadway, New York, N.Y., Phone WOrth 4-2211

Infra Insulation, 525 Broadway,
New York City, Dept. H-9
Please send me sample of New Infra Insulation ☐
Copy of Schwartz's "Simplified Physics" ☐

Name_____

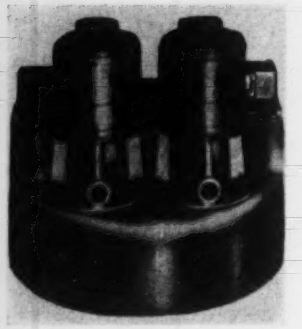
Address_____

trolled from the monitor and uses standard 16 mm movie lenses. [Manufacturer: Radio Corp. of America, Engineering Products Dept., Camden, N. J.]

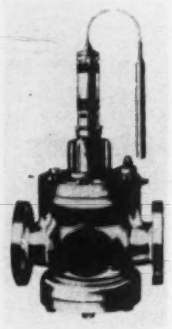
Condensation Pump

"CV" centrifugal condensate pump and receiver in single and duplex models . . . . It is designed for returning condensate to the boiler or other points from low pressure steam heating systems and process equipment. The motor is the capacitor type, 1/3 hp, single phase, 3500 rpm. Automatic control consists of an enclosed float switch of the double pole type. The duplex units are available with two floats in the receiver and two float switches. Each float and switch mechanism controls its individual pump motor. The duplex unit also is available with one float in the receiver which controls a mechanical automatic alternator. The alternator provides a means of alternating the operation of two pumps installed on a duplex unit with a common receiver.

Manufacturer—Skidmore Corp., St. Joseph, Mich.



Pump



Regulator

Temperature Regulators

Self-operating temperature regulators, Type V1000 direct acting for heating applications, and Type VR10000 reverse acting, for cooling. . . . A single seated pilot valve positions the piston of the main valve which controls the throttling position of the main valve disc. Built-in self cleaning steam strainers are designed to protect the vital parts of both the pilot and main valves. A liquid filled thermal system consisting of 8 ft of nickel plated copper capillary and bulb, is supplied. Sizes range from 2 in. to 4 in. and the regular is useful for controlling temperatures from 25 to 275 F through a 50 deg range. Maximum pressure limit is 125 psi.

Manufacturer—Farris Stacon Corp., 563 Commercial Ave., Palisades Park, N. J.

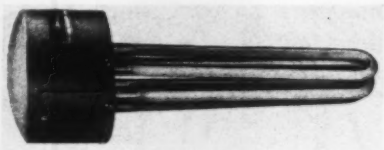
Shutoff Safety Valve

**Automatic shutoff safety valve for checking fuel-fed fires. . . .The valve is a quick-closing type that is normally held in an open position by an actuating head that operates like a standard sprinkler head. At the specified temperature, the head opens and releases tension on a stainless steel spring which closes the valve in a fraction of a second, the company states. The valve is said to be explosion proof and in case debris or blast knocks off the head, the valve will close to prevent fire or explosions. It is designed to operate in any position.

Manufacturer—Valco, Inc., 1410 West St., Cincinnati 15, Ohio.

Electric Immersion Heater

Flanged tubular-type electric immersion heater used for heating water, oil or paraffin. . . . New heater supplements the "Chromalox" line by providing



a higher heat output and a new size flange 5⅜ in. in diameter. Heating elements of the unit are available in two sheath materials. Type TM-4, for water heating, has copper sheathed elements brazed to a brass flange. Type TMO-4, for use in oil or paraffin, has steel sheathed elements welded to a cast iron flange. Both types are single phase only and available in 120, 240, 480 and 550 volt ratings with capacities ranging from 4 to 12 kw.

Manufacturer—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8, Pa.

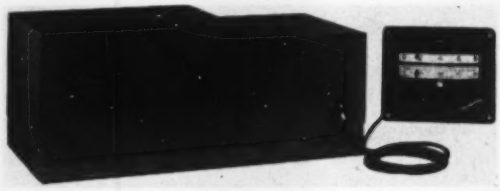
Weld-Backing Compound

Silicone weld-backing compound designed for greater welding flexibility. . . . The compound promotes uniform penetration and is said to eliminate the harmful effects of air on the underside of welds. Made from "bouncing putty," the silicone weld-backing compound is similar to paint in appearance and does not require the addition of any other ingredient before use. One coat, ½ in. wide, applied with a brush to the back of the joint, will give adequate protection, according to the company's engineers. A pint applied in this manner will cover more than 1300 linear ft.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Temperature Control

*"Stepless" temperature controller which has no relay and supplies only enough power to the heating element to hold the temperature for which it is set. . . . Made up of two sections, one section contains the temperature indicator, parts of the instrument

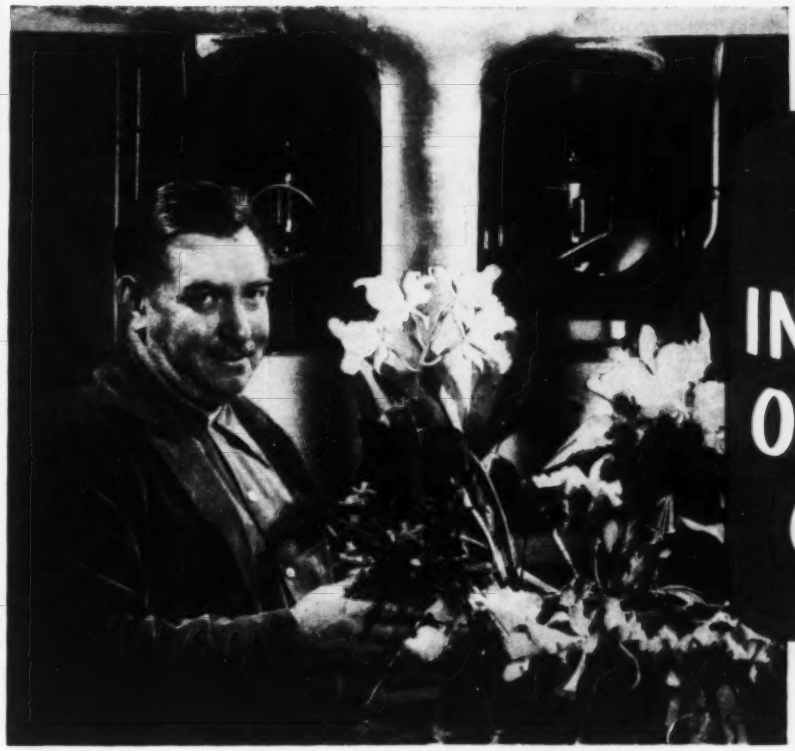


control circuit and the control pilot lights, while the other contains the heavier part of the controller circuit. A six conductor cable connects the two sections. One vacuum tube is used. The temperature is indicated in a 5-in. scale, mirrored for parallax correction.

Manufacturer—West Instrument Co., 525 N. Noble St., Chicago 22.

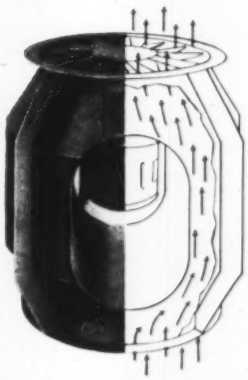
Relief Valve for Gas-Oil Burners

*Piston-type, oil relief valve for regulating pressure on the firm's closed flame gas-oil burners. . . . The new valve, according to the manufacturer, does



LIFE INSURANCE ON 10,000 ORCHIDS

Orchid grower Walton Riffe, owner of Walton's Greenhouse, Dayton, Ohio, with some of his rare specimens. The two DeBothezat Induced Draft Bifurcator Fans in the background are mounted in the boiler breeching. Each fan serves two boilers.



HOW BIFURCATOR WORKS

The Induced Draft Bifurcator is a motor driven axial-flow fan in a divided housing. Motor is in an isolated chamber around which flue gases are by-passed (bifurcated) so that the motor always remains cool, clean and accessible. Induced Draft Bifurcators are built in twenty-four sizes, for high pressure boilers delivering up to 60,000 pounds of steam per hour and for low pressure boilers rated up to 190,000 EDR.

A sudden drop in temperature can put an orchid grower out of business overnight. That's why Walton Riffe installed an automatic heating plant, complete with stand-by boilers, in his greenhouses.

To be sure of adequate boiler draft at all times, this famous grower mounted two DeBothezat Induced Draft Bifurcator Fans in the breeching. Now, Mr. Riffe doesn't worry. Dependable DeBothezat Induced Draft Bifurcator Fans produce a positive controlled draft that helps his system to maintain tropical temperatures regardless of weather.

Remember DeBothezat Induced Draft Bifurcator Fans the next time you have a stack problem. These fans provide a constant, controlled draft for boilers and furnaces at all times. They permit boilers to operate at maximum efficiency under any load, regardless of weather. And the cost of an Induced Draft Bifurcator Fan is usually only a fraction of the cost of erecting an old-fashioned brick or steel stack.

Ask your DeBothezat representative — you'll find him listed in the phone book under "Ventilating Equipment" — or write our factory, Dept. HP-953, for illustrated catalog DB-32-52.

DeBothezat Fans

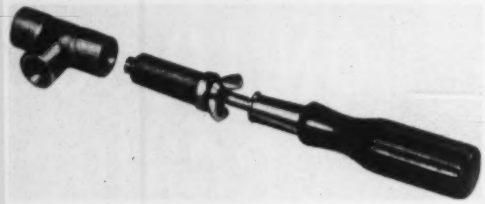
Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

away with chattering and pulsation. A cylindrical steel piston closes the port with a shearing action to eliminate the pounding noise. Pressure in the valve is regulated by adjusting tension of the spring inside the piston. Five spring sizes permit a range of pressures from 0 to 500 lb. The valves are available in four sizes from 3/8 in. port to 1 in. port.

Manufacturer—Eclipse Fuel Engineering Co., 1139 Buchanan St., Rockford, Ill.

Cleaning Tool for Copper Fittings

**Copper fitting cleaning tool designed to clean to the bottom of the fitting. . . . A rubber bonded abrasive is used to give the tool longer wear. As the

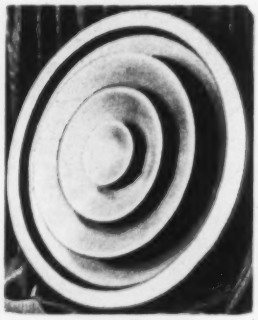


abrasive wears the wing nut is tightened to expand the cylinder.

Manufacturer—Arcee Products, Pawtucket, R.I.

Ceiling Diffuser

Addition of Type "P" Series to line of "Aerofuse" ceiling diffusers. . . . The new line consists of five diffuser types: Type "PA" is an adjustable, multi-passage diffuser designed so that the air distribution pattern may be varied from horizontal to vertical; Type "PS", stepped-down type, fixed pattern diffuser; Type "PF", flush type, fixed pattern diffuser; Type "PR", flush type, fixed pattern supply and return diffuser; Type "PH",



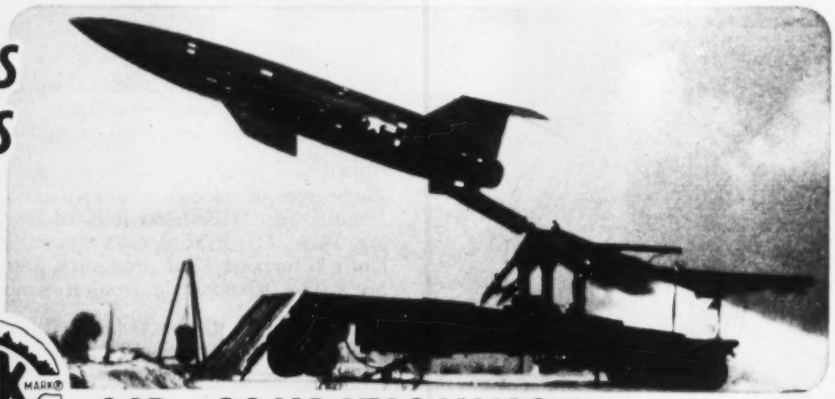
flush type, fixed pattern half round diffuser. All types and sizes have matching facial contours and the identical number of rings. A removable center ring assembly is designed to facilitate installation.

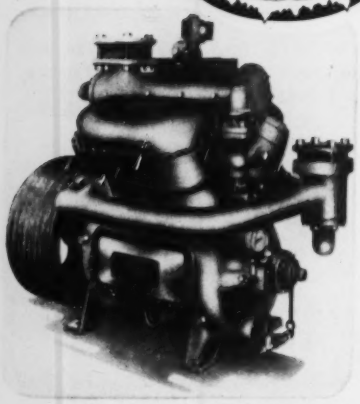
Manufacturer—Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.

Electric Jig Saw

Portable electric "Utility" jig saw designed to do the work of a jig saw, sabre saw, keyhole saw and most band saw operations. . . . It can be held and guided with one hand and is supplied with five different types of blades for cutting wood, ferrous and nonferrous metals, insulating materials, etc. It can be

PILOTLESS BOMBERS MADE WITH FRICK TRADE MARK® AIR CONDITIONING



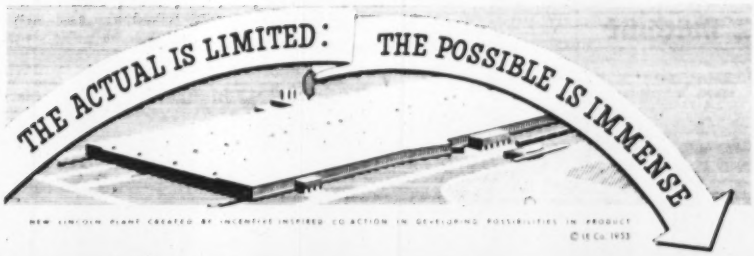


The Glenn L. Martin Company, builders of "Matador" bombers, "404" transports, and other famous planes, uses 27 Frick compressors for air conditioning and special cooling services in its great plant at Middle River, Md. These machines have been installed over a period of 16 years by the Paul J. Vincent Co., Frick Distributors in Baltimore.

For the last word in dependability and convenience, specify Frick air conditioning, refrigerating, ice making and quick freezing equipment. Let us quote on your cooling needs NOW.

Frick "ECLIPSE" Compressors Handle Air Conditioning Work with Extra Economy: ask for details.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.



"LINCWELDER'S" SELECTIVE ARC ASSURES LOW COST WELDING

"LINCWELDER'S" Dual Continuous Control gives you the right arc for every job every time. The *right type* of arc combined with the correct *arc intensity* is instantly available by simple setting of dial. Built with rugged industrial-type construction, "Lincwelder" gives you greatest dependability at lowest cost of any welder of its type today. Reports show this welder is unsurpassed for welding carbon steels, alloy and stainless steel as well as non-ferrous metals on all types of plain maintenance, hard-surfacing and production work.

GET COMPLETE FACTS from free Bulletin 1332.
Write on your letterhead to Dept. 3802.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

UNIQUE WELDING IDEA SIMPLIFIES PIPING SPEEDS INSTALLATION

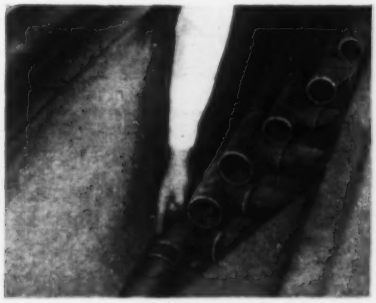
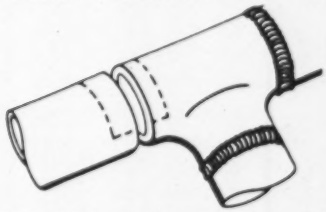
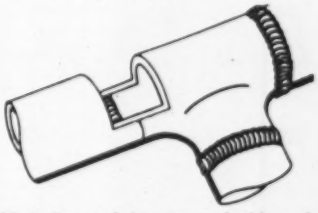


Fig. 1. Arc welding joints in 3" drain pipe on the bottom of concrete gutters were made simpler by cutting out windows and welding from the inside. This unique welding procedure simplified installation . . . saved time and money at the new transformer service shop of the Illuminating Company, Cleveland, Ohio. Piping contractor Smith and Oby Co., Cleveland, Ohio.

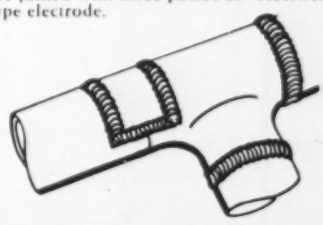
STEP 1. Fittings are welded to pipe before it is lowered into concrete gutters. The problem is to weld bottom of joints.



STEP 2. Windows are cut out of top half so welder can get electrode inside of pipe.



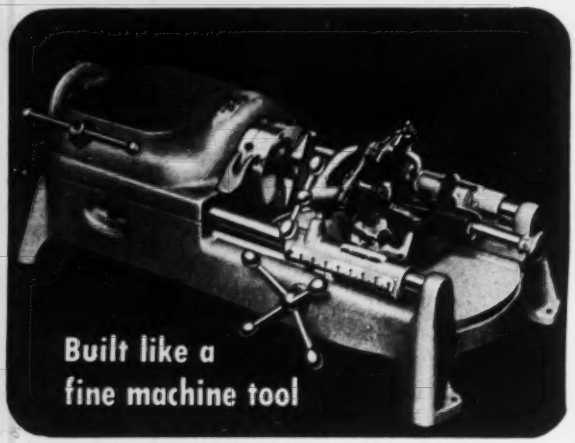
STEP 3. Exposed bottom and sides of pipe are joined with three passes of "Fleetweld 5" type electrode.



STEP 4. Window is welded closed in a leak-proof, high quality welded joint.

The pipe and bolt threading machine that gives you

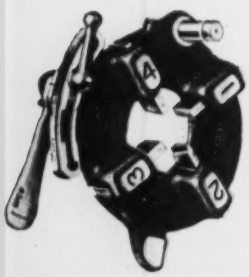
Top Performance RIDGID "500"



...with exclusive new quick-opening

Quadritype Die Head

RIDGID engineering does it again! New "500" threads, cuts and reams with the efficiency and speed you've long wanted. Ready for work on any size pipe, ⅛" to 2", in seconds! Independent operation of tools, more than ample power, concealed oil system — a score of other great new features. No wonder its popularity has been immediate and wide-spread. See it, try it at your Supply House — buy the more-for-your-money RIDGID "500"!



New Quadritype die head adjusts instantly 1" to 2" regardless of position of lever, without removing dies or head from machine. Same work-saver feature in Dualtype die heads—¼" and ⅜", ½" and ¾". Monotype also available, ⅛" to 2"—also bolt die heads, ¼" to 2".

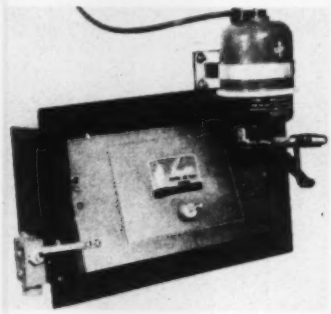
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

mounted in an accessory table for bench work. The saw is powered by a motor for use on 115 volt a-c or d-c current. According to the manufacturer, it should prove useful to electricians, pipefitters, in maintenance shops, etc.

Manufacturer—Black & Decker Mfg. Co., 628 Pennsylvania Ave., Towson 4, Md.

Electric Draft Control

**New line of models of electric draft control for residential and small commercial applications. . . . The control consists of two damper openings. A smaller damper operates barometrically when the stoker or burner is firing. When the heating plant shuts off, a

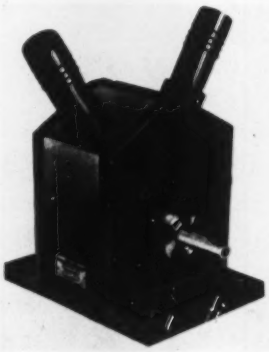


larger electrically operated draft gate takes over. This electrically operated check damper automatically moves to a full open position, by-passing about 80 percent of the chimney pull. At the point of peak heat, the chimney is forced to make most of its pull from the room rather than from the combustion chamber of the heating plant, the manufacturer claims.

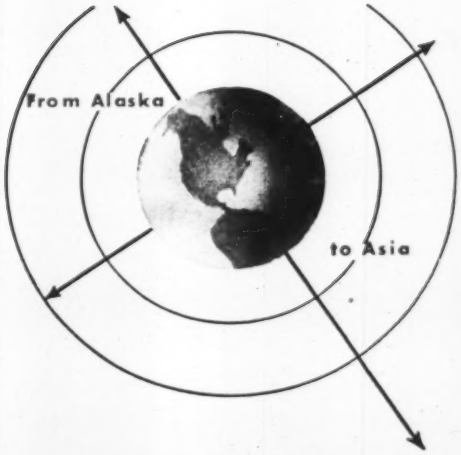
Manufacturer—Fuel Reduction Corp., 220 N. Ada St., Chicago 7.

Hard Rubber Pump

*PXHR Series "Flex-i-liner" pump utilizing a newly developed "Buna N" hard rubber body block for withstanding temperatures up to 225 F and the corrosive effect of many acids. . . . According to the

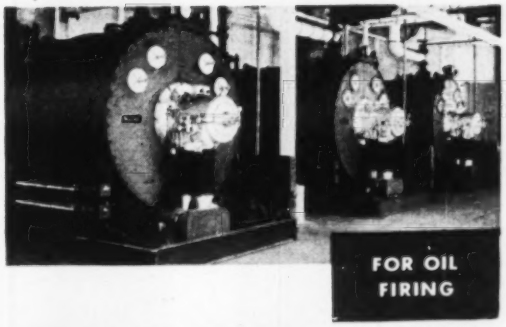


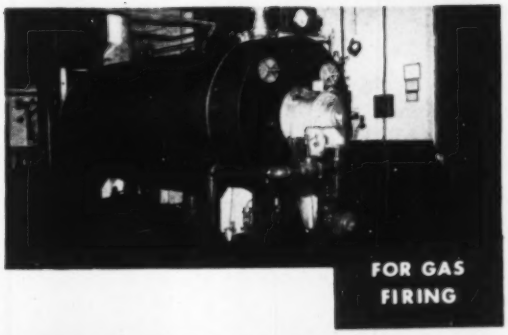
manufacturer, the design of the pump eliminates stuffing boxes and shaft seals as well as the need for check valves or gaskets. The pump is activated by an eccentric rotor and shaft assembly which rides inside a molded flexible liner. The fluid which is trapped on the outer surface of the liner and the inner surface of the body block is squeezed through the pump. The fluid is not in contact with metal. Pump capacities are from 1/3 to 20 gpm

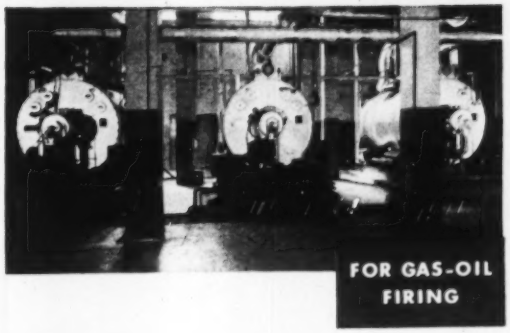


Powermaster®

is a world-wide choice for LOW-COST STEAM


FOR OIL FIRING


FOR GAS FIRING


FOR GAS-OIL FIRING

All over America—in U.S. Possessions . . . in Canada . . . South America . . . Europe . . . Asia . . . Africa—thousands of *Powermaster* Packaged Automatic Boilers are now supplying steam and hot water requirements—with outstanding reliability and economy for:

bakeries • beverage plants • canners and food processors • chemical plants • dairies • dry cleaners • hospitals and institutions • hotels • apartment and office buildings • laundries • meat packers • public schools and colleges • tanneries • textile mills • tire and rubber companies • paper mills • railroad shops • manufacturing plants • and many other users.

A large percentage of present users have ordered additional *Powermaster* units . . . and the list of new *Powermaster* users is getting longer every day.

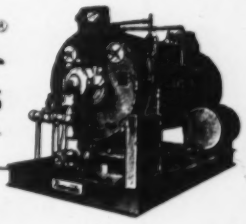
HERE'S WHY — Ease and economy of installation—space-saving compactness—fuel-saving smokeless VORIFLOW combustion—highly efficient operation at all loads—maintenance-saving accessibility—forced draft—full-range automatic modulating firing control—completely automatic operating and safety controls—these are some of the reasons for the steadily growing universal preference for *Powermaster.*

If selecting, installing, or operating boilers is your business, you'll want the complete story of Powermaster cost-saving advantages contained in this new bulletin.

Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • Established 1885 • **990 Morgantown Road, Reading, Penna.**

Johnson & Johnson's

new Shipping Center in Raritan Township, N. J., calls for the maximum in efficiency and trouble-free Multi-blade Damper operation. All of the 60 Damper units installed by the Hutchinson Ventilating Co., White Plains, N. Y., were assembled with . . .

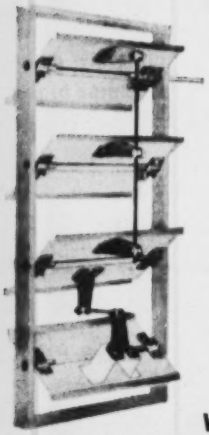
Damper being inspected at the Hutchinson shop. Self-centering feature of "Duro Bracket" assures smooth, non-binding operation.

"DURO BLADE KIT"

PRECISION-ENGINEERED

DAMPER HARDWARE

Thousands of Engineers and Sheet Metal Fabricators specify and use "Duro-Blade-Kit" on their Damper jobs, because...



Model shows how either parallel or opposed blade action is accomplished.

- Produces highest quality commercial Damper known.
- Self-centering "Duro Bracket" assures smooth, non-binding operation.
- Sturdy, solid construction permits use on heaviest Dampers.
- All materials corrosion-resistant.
- Fits all blades 3 inches or wider. Parallel or Opposed Blade action.
- Easily adjusted even after being installed.
- Excellent for making Approved Fire Dampers.

WRITE for Free Demonstration Kit and illustrated Manual on the construction of "Approved" Dampers

DURO-DYNE CORPORATION Dept. D

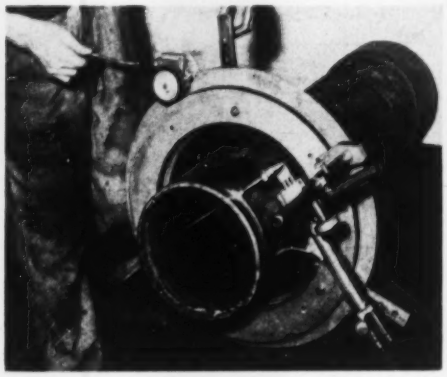
38 SOUTH FRANKLIN STREET, HEMPSTEAD, L. I., N. Y.

with a pressure range from 0-60 psi. They are self-priming with suction lifts up to 24 in. Hg.

Manufacturer—Vanton Pump Corp., Empire State Bldg., New York 1.

Acetylene Torch Cutter for Pipe

**Acetylene torch cutter which the manufacturer claims will cut and bevel steel pipe in 1½ min. . . . The cutter has a traveling carriage attachment and clamp which holds the torch in a fixed position in relation to the pipe as it rotates. The machine is

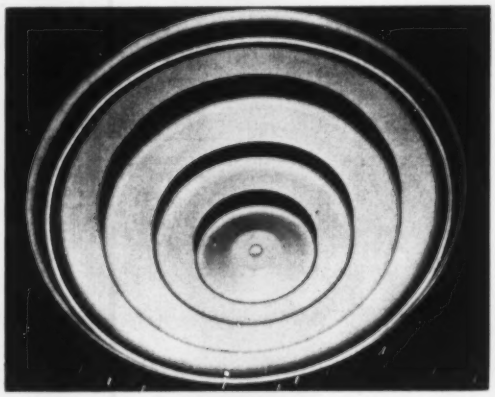


designed to keep the torch at a proper distance and angle and is mounted on a precision universal chuck. A hand operated crank is used to advance the torch. It is available in two sizes, 4 to 12 in., and 12 to 20 in.

Manufacturer—Springload Mfg. Corp., 2412 Aurora, Seattle, Wash.

Circular Ceiling Diffusers

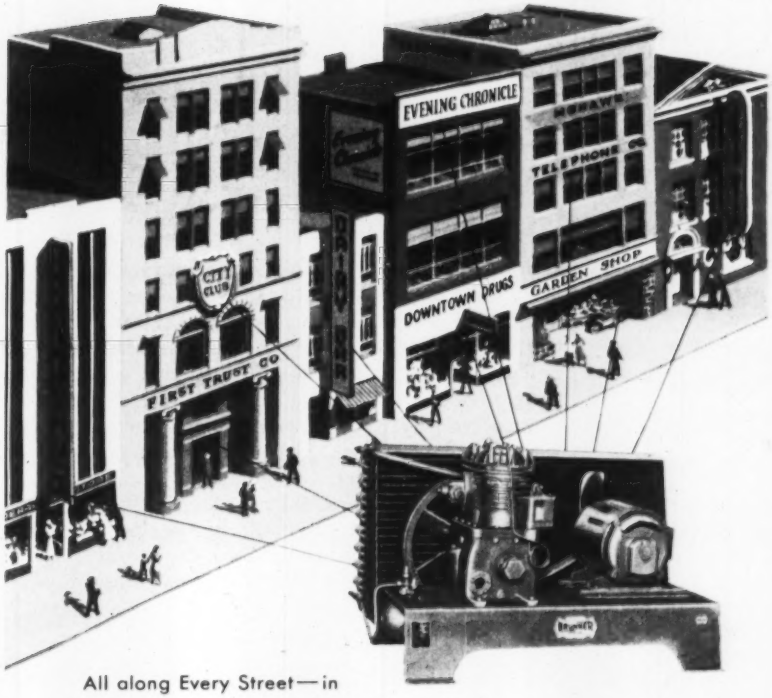
Three new models of circular ceiling diffusers in sizes from 5 in. through 32 in. all identically styled. . . . Model "E" is a fixed cone diffuser in which the cone assembly can be set to secure a horizontal, ver-



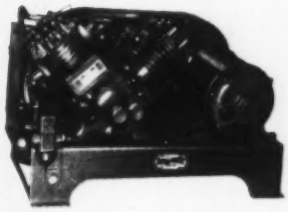
tical or intermediate air pattern. Model "EI" is an adjustable supply unit where any desired air pattern can be obtained by rotating the center plate. Model "ER" is a combination supply and exhaust diffuser that is designed to be used to bring in the supply air and exhaust the room air from the same location. The air pattern is set to minimize the danger of short circuiting the supply air.

Manufacturer—W. R. Carnes Co., Verona, Wis.

UP the street... DOWN the street...
BRUNNER delivers
DEPENDABLE REFRIGERATION

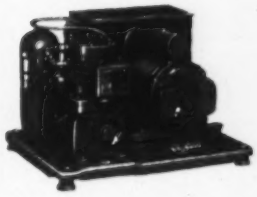


All along Every Street—in hundreds of places, on hundreds of different jobs—Brunner equipment is the popular choice of users and servicemen alike for trouble-free, economical refrigeration. One reason, of course, is that Brunner makes the industry's most complete line of open-type condensing units —the *right* model and size for every commercial requirement. Easier to install... easier to service—Brunner refrigeration saves *your* time—and your customers' money!



Brunner's famous slow-speed compressor—heart of every unit—assures LONGER life, LESS servicing, LOWER operating and maintenance costs.

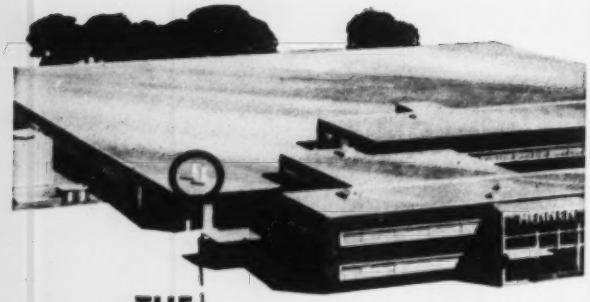
SEE YOUR BRUNNER REPRESENTATIVE . . . see the big Brunner line. You'll see profit opportunities that no other source can give you—the finest equipment, backed by one of the finest service organizations in the refrigeration field. Write us for catalog and complete information . .



BRUNNER MANUFACTURING COMPANY
Dept. L-93, UTICA, N. Y., U. S. A.

IN CANADA: Brunner Corporation (Canada) Limited, Toronto, Ontario

YOU'LL ALWAYS BE GLAD YOU INSTALLED A BRUNNER SINCE 1906



THE MENNEN CO.

A. M. KINNEY, INC.
Architects & Consulting Engineers
Cincinnati, Ohio

Chooses

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CYCLONIC COMBUSTION

TO SOLVE A COMPLEX STEAM PROBLEM

The Mennen Company chose for their new ultra-modern plant and general office building in Morris Township, N. J., two 350 h.p. Cyclotherm Steam Generators to provide dependable steam for three separate and vitally important factors in their plant operation.

1. FOR PRODUCT PROCESSING

Constant steam is required for production in processing the many Mennen products. Cyclotherm has proven its reliability in thousands of installations throughout the world where steam loads vary, maintaining its high rate of efficiency and low rate of fuel consumption.

2. FOR AIR CONDITIONING

The Cyclotherm Steam Generators will provide 6,840 lbs. of steam per hour required to run two 180 ton absorption refrigeration units for Mennen's unique air conditioning system.

3. FOR PLANT AND OFFICE HEATING

To provide efficient heating for the 264,000 sq. ft. of plant and office space, Cyclotherm was again the first choice.

FIND OUT HOW Cyclotherm Steam or Hot Water Generators can give you: Guaranteed minimum efficiency of 80%; Full power from a cold start in 15 to 20 minutes; Increased savings on fuel and maintenance and many other advantages that are essential in your complex steam problem.

*Reg. trade name

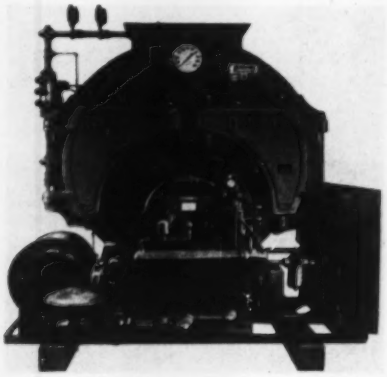
WRITE TODAY for your copy of "All Your Questions Are Answered by Cyclotherm." Just drop a card to Cyclotherm, Dept. 26, Oswego, N.Y.

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM DIVISION UNITED STATES RADIATOR CORP. — OSWEGO, NEW YORK

Boiler-Burner Unit

*Boiler-burner unit for high and low pressure steam and for hot water heating jointly manufactured by the Kewanee-Ross Corp. and Ray Oil Burner Co. . . . The unit is being manufactured for high pressure

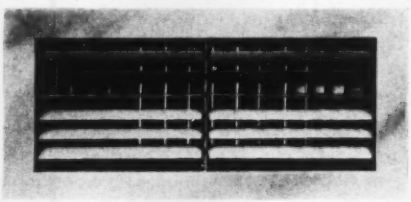


steam to produce 39 to 456 certified output horsepower at 125 and 150 lb wp and for low pressure 15 lb steam or 30 lb water in sizes to produce 1,313,000 to 15,300,000 Btu per hr. According to the manufacturers, the unit is designed for forced draft operation with a multistage secondary air control on the burner to provide a constant velocity type air stream to the combustion zone with a high turbulence, high turn down ratio and high carbon dioxide content.

Manufacturers—Kewanee-Ross Corp., 101 Franklin St., Kewanee, Ill. and Ray Oil Burner Co., 1301 San Jose Ave., San Francisco 12, Calif.

Airfoil Register

Airfoil register No. 277 combines a four-way directional grille with opposed blade dampers. . . . The manufacturer states that this design provides for maximum directional control and positive volume control.



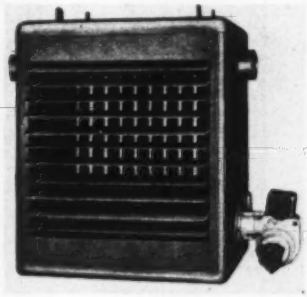
The opposed blade dampers are designed to supply a uniform distribution of air to the entire grille face. Louver depth is ¾ in. The front louvers are individually adjusted and the damper blades in the rear are key-operated.

Manufacturer—Titus Mfg. Corp., 113 E. 8th St., Waterloo, Iowa.

Oil Fired Unit Heater

**Unit heater which is fired with a conventional gun-type oil burner. . . . Known as Model UH220, it has a heat output of 220,000 Btu per hr when fired with a 2 gal per hr nozzle. According to the manufacturer, a large ½ hp propeller fan and motor will throw the heated air 150 ft. The louvers in the front

of the heater are adjustable to vary the direction of the air. Hanging hooks are provided for suspending the heater from the ceiling. A vertical flue travel is designed



to permit the products of combustion to be exhausted into the atmosphere through a short flue pipe.

Manufacturer—The Delta Heating Corp., Trenton, N.J.

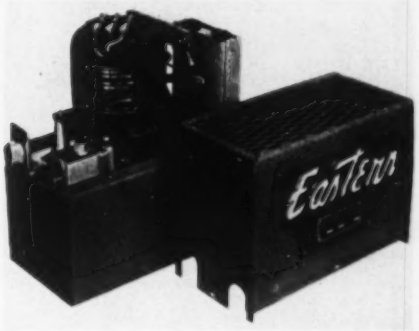
Condensate Return Pump

Small condensate return pump which occupies less than 1½ sq ft of floor space. . . . The "Lowboy" has a low condensate return inlet, less than 7 in. from the floor. Special design features provide for the entire motor, pump and switch assembly to be lifted out for service without the need for special tools. The counterweight operated switch is in the motor housing. The discharge may be rotated to any of four 90 deg positions. According to the manufacturer, the seal-less construction eliminates packing glands, rotary seals, O-rings, etc. An overflow connection takes the place of the vent and is designed so that it cannot be plugged. Capacity is 3000 sq ft EDR.

Manufacturer—Sterling, Inc., 3738 N. Holton St., Milwaukee.

Condensate Disposal Unit

Model No. 3, Type 100 automatic condensate disposal unit with mercury switch. . . . It is designed to remove hot or cold condensate fluid from the brass receiver tank and pump it to an outside drain. The



motor is a ball bearing induction type. The pump is the bronze centrifugal type.

Manufacturer—Eastern Industries, Inc., 396 Elm St., New Haven 6, Conn.

Compact Industrial Heater

Model "E-600" heating unit the size of an orange crate designed to have the heating potential of

ELECTRO
Extra
DYNAMIC
Dependable industrial motors

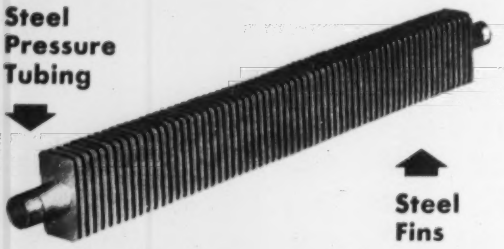
E.D. motors are engineered for *silent* operation with special slot design, dynamic balancing and scientific bearing assembly.

FOR QUIETER OPERATION . . . Over half a century of building motors for "the silent service" to power and air-condition U. S. submarines has given Electro Dynamic an unequalled experience in producing motors for installations where SILENCE is a primary consideration.

WRITE TODAY FOR CATALOGUE NO. 981

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS CORPORATION
BAYONNE, NEW JERSEY

STEEL TO STEEL KEEPS FINS TIGHT



Maximum efficiency in finned radiation requires perfect, continuous contact between fins and pipe at all times for only when this contact is perfect will there be maximum heat transfer from pipe to fins and from fins to room air.

AUTORAD uses steel for *both* tube and fins and since the coefficient of expansion of fins and tubing is the same, no amount of expansion or contraction can lessen the bond between them and decrease heat transfer. And no electrolytic action can destroy the perfect bond.

AUTORAD has developed a method of bonding fins to tubing so that the resulting contact is as firm and perfect as a welded joint. As a consequence heat transfer is kept at peak efficiency.

To you as a contractor this means long years of customer satisfaction and customer satisfaction means greater profits to you.

Ask for complete data and prices.

AUTO-RAD Inc.

3535 Fillmore Street, Chicago 24, Illinois

an average furnace. . . . The heater produces 60,000 Btu's of fresh air output per hr and weighs 114 lb including the fuel, the manufacturer states. The self-contained unit includes a centrifugal pressure-type dual blower which separates the ventilating air from combustion air while using one motor. It can be operated from 110 volts a-c or 24 volts d-c and contains its own power rectifier. Fuel oil or gasoline may be used. A non-clog fuel metering jet is designed to maintain a steady flow of fuel regardless of temperature changes or viscosity of fuel.

Manufacturer—Perfection Stove Co., 7609 Platt Ave., Cleveland 4.

EQUIPMENT BRIEFS . . .

MOTOR REVERSING SWITCH for air conditioners and other applications involving a single-phase motor whose direction must be reversed. . . . The two-pole switch has ratings of 1 hp at 120 volts and 2 hp at 240 volts, a-c. "Auto-lock" connections provide hook-up by pushing the stripped end of standard wire into the connection.

Manufacturer—The Hart Mfg. Co., 110 Bartholomew Ave., Hartford, Conn.

TORQUE-LIMITING WRENCH that is calibrated in inch pounds. . . . Capacities of the new torque wrenches are 100-750 and 700-1600 inch pounds. Three models have a plain head and three have a built-in reversible ratchet head. Drive sizes are $\frac{3}{8}$ in. and $\frac{1}{2}$ in. "Proto" wrenches are designed to release at proper setting and reset themselves automatically.

Manufacturer—Plomb Tool Co., Los Angeles, Calif.

HYDRAULIC POWERED MACHINE for expanding and sizing metal tubing. . . . The vertical machine is a manually controlled type that is adapted to the expansion and sizing of copper tubing in evaporator and condenser coil assemblies.

Manufacturer—Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19.

GAGE to obtain a sample of the bottom content of a tank. . . . The gage is fastened permanently to the end of a standard liquid storage tank measuring stick. It is designed to show a cross-section measurement of the water, sludge and other foreign matter drawn by the suction line. A trip valve closes upon contact with the bottom of the tank permitting a content sample to be raised.

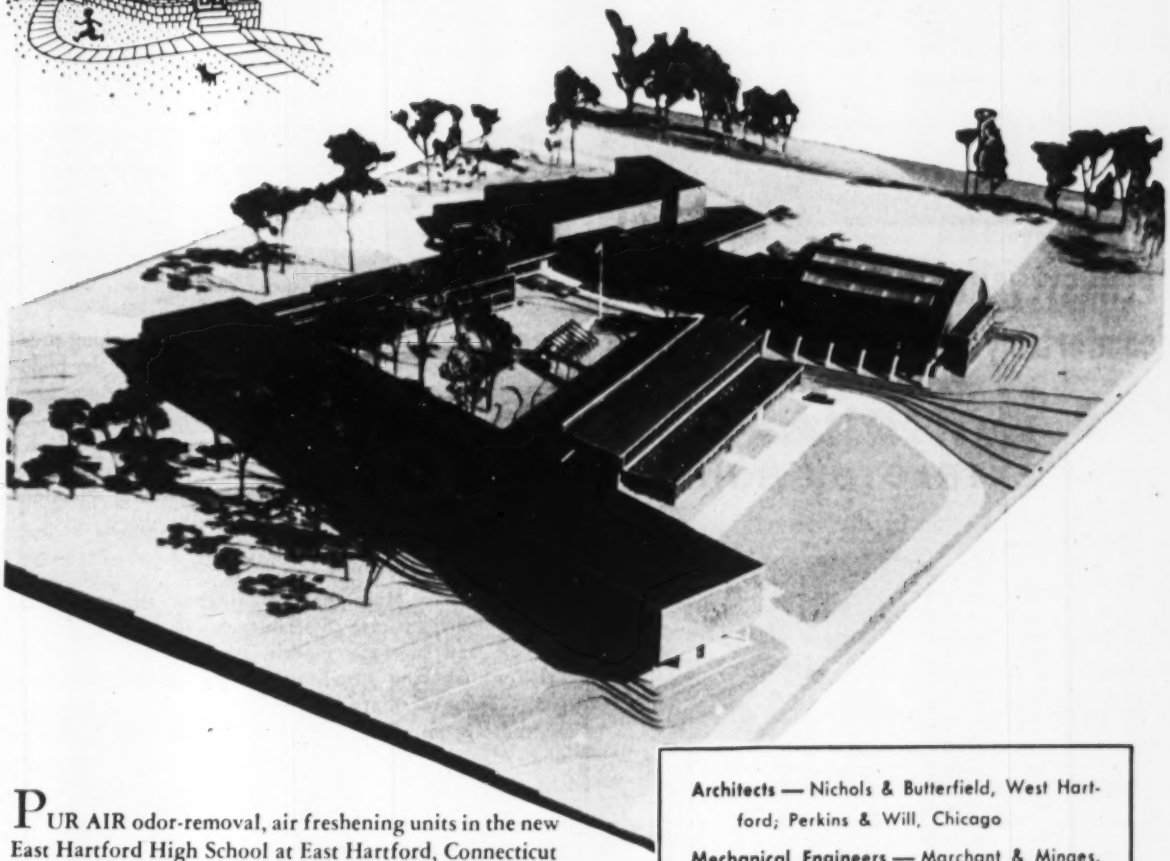
Manufacturer—Visa-Test Sales Co., 1515 Alturas Dr., Burlingame, Calif.

ADJUSTABLE TIME DELAY, manually or mechanically operated, for introduction into a mechanical circuit. . . . "Agaswitch" is designed for use on control boards, box assemblies, etc. Type I begins its time delay as soon as pressure is applied to the lever. Type II starts the delay a pre-set length of time after pressure has been applied to the lever and is released again. The pneumatically-timed delay period is adjustable from 0.1 to 10 seconds.

Manufacturer—Elastic Stop Nut Corp. of America, 1027 Newark Ave., Elizabeth, N.J.

The Little Red School House was Never Like This!

"PROGRESSIVE EDUCATION" IN PURIFYING AND RE-USING AIR SAVES $5,000 YEARLY ON HEATING



PUR AIR odor-removal, air freshening units in the new East Hartford High School at East Hartford, Connecticut will pay double dividends. First, students will enjoy cleaner, fresher, more healthful air, and second, savings on the fuel bill will be a substantial $5,000 annually. By recirculating and purifying confined air thru Pur Air, Activated, Coconut-Shell Carbon Adsorbers (filters), less re-heating of outside air is needed. Projected over a 20-year period, the estimated $100,000 savings would pay for the Pur Air installation many times over. For complete details on the story of Pur Air, Activated, Coconut-Shell Carbon for odor-removal, call your local Pur Air representative, or write:

Architects — Nichols & Butterfield, West Hartford; Perkins & Will, Chicago

Mechanical Engineers — Marchant & Minges, West Hartford

General Contractor — A. F. Peaslee, Inc., Hartford

Heating Contractor — Thos. G. Shaffer, Inc., Hartford

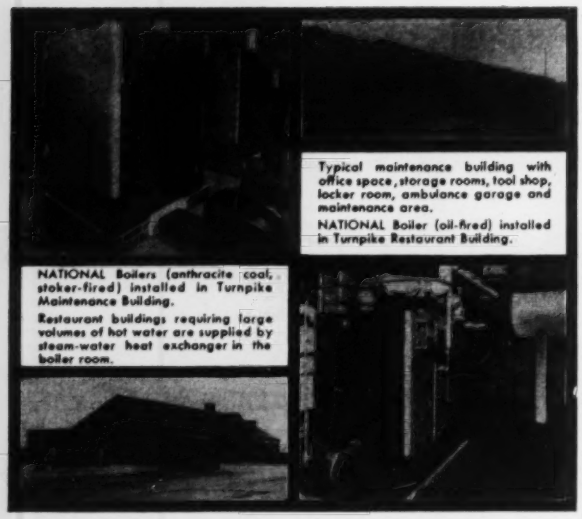
Sheet Metal Contractor — Automatic Refrigeration Co., Hartford

Pur Air Representative — Augur, Jones & Green, Hartford

Pur Air DIVISION

BARNEBEY-CHENEY *Company*

N. Cassady at Eighth Columbus 19, Ohio

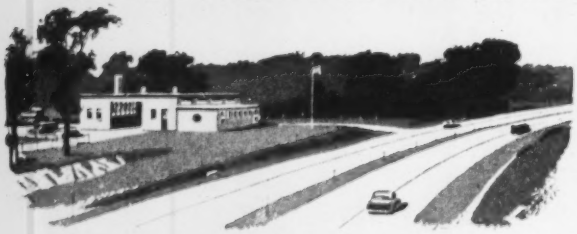


Typical maintenance building with office space, storage rooms, tool shop, locker room, ambulance garage and maintenance area.
NATIONAL Boiler (oil-fired) installed in Turnpike Restaurant Building.

NATIONAL Boilers (anthracite coal, stoker-fired) installed in Turnpike Maintenance Building.
Restaurant buildings requiring large volumes of hot water are supplied by steam-water heat exchanger in the boiler room.

PENNSYLVANIA TURNPIKE BUILDINGS
comfortably heated round-the-clock by

36 NATIONAL (CAST IRON)
HEAT EXTRACTOR BOILERS



Section of Pennsylvania Turnpike showing a maintenance building and area.
Architects: J. E. Greiner Company, Baltimore, Md.
Heating System Designers: George & Hartman, Baltimore, Md.
Heating Contractors: W. L. Ramsey, Harrisburg, Pa.; J. J. Betke, Beaver Falls, Pa.; John Galbreath, Pittsburgh, Pa.

Heating comfort is assured in the restaurant, maintenance, utility and toll gate buildings on the famous 327-mile Pennsylvania Turnpike. Maintenance buildings are supplied with adequate heat to thaw cinders by the truckload. Abundant domestic hot water is also furnished by tankless water heaters for washrooms . . . and, in the restaurants, boilers heat water for dishwashing.

Heat Extractors along one stretch of the Turnpike are oil-fired . . . the others are anthracite coal, stoker-fired. Convectors, unit heaters and radiant panels are used for heat distribution.

Send for details about National Heat Extractor Boilers . . . sizes available for all applications—from small homes to large buildings.

Write for bulletin No. 586-9-HP

THE NATIONAL RADIATOR COMPANY
JOHNSTOWN PENNSYLVANIA

RECENT TRADE LITERATURE . .

Air Handling Units

Bulletin 1600 describes the features of a complete line of air handling units for industrial and commercial heating, ventilating and air conditioning applications. Detailed installation possibilities are given for central plant air conditioning, exhausting heat fumes or vapors and heating and ventilating requirements where cooling is not needed. The booklet also contains descriptions of accessories such as humidifiers, mixing boxes and filter sections.

Manufacturer—Westinghouse Electric Corp., Sturtevant Div., Dept. T-071, 200 Readville St., Hyde Park, Boston 36.

Air Hose in Industry

Described in a new bulletin is a number of different uses for the company's line of air hose. The uses vary from heavy-duty construction through digging and drilling operations, to many heavy and light industrial and commercial uses. The bulletin includes cross section and cutaway photographs, as well as performance data, constructions, sizes, weights, working pressures and recommended uses. Also covered in the bulletin are the types of couplings best suited for the specific hose.

Manufacturer—Quaker Rubber Corp., Div. of H. K. Porter Co., Inc., Tacony and Comly Sts., Philadelphia 24. Requests for copies should be addressed to the attention of W. M. Taylor, Adv. Mgr.

Arc Welding Machines

More than 20 different models of arc welding machines are described in this new catalog. A-c, d-c and inert-gas models are illustrated with descriptions covering specifications, features and electrical data. There also are sections on the accessories and electrodes required to perform a particular arc welding job. Also discussed are various types of running gear, foot controls and an automatic arc welding head.

Manufacturer—Air Reduction Sales Co., 60 E. 42nd St., New York 17.

Blowers and Exhausters

Bulletin B-6 catalogs information on centrifugal blowers and exhausters for air or gas handling. Performance data and typical applications are given. Technical data is included on agitation of liquids, air for combustion, air for foundry cupolas, ice making, vacuum cleaning and pneumatic conveying. Fundamental engineering laws for blower applications are given as well as altitude and temperature correction factors, pressure equivalents, and friction loss and velocity tables.

Manufacturer—Lamson Corp., Billmyre Blower Div., Syracuse 1, N. Y.

Compression Pipe Coupling

Folder 103 explains how compression coupling is designed to eliminate the necessity of threading, flaring or grooving prior to installation of pipe unions. Included are operating diagrams plus a specification chart and price list.

Manufacturer—Morris Coupling and Clamp Co., Ellwood City, Pa.

D-C Motors and Generators

Bulletin No. 1150 covers the company's line of d-c motors, ½ to 300 hp, and d-c generators, ¾ to 250 kw. Photographs and cutaway drawings show details of mechanical construction, motor enclosures for different operating conditions and motor applications. The bulletin also includes a section on motor-generator sets for converting alternating current to direct current in industrial service. Motor starting information is included as well as a section on adjustable speed applications.

Manufacturer—Louis Allis Co., 427 E. Stewart St., Milwaukee 7, Wis.

Fluid Flow Rate Meters

Catalog 32 illustrates and describes porcelain, glass and metal "Flowrator" fluid flow rate meters employing the variable area principle as designed and used for corrosive services. The catalog includes descriptions of porcelain meters with metal armoring for shock resistance, hard lead meters with Hastelloy "C" floats for sulphuric acid solutions, rubber-lined meters for use in rubber-lined pipe systems, and various types of glass meters. Capacities and dimensions for the several types of meters are listed.

Manufacturer—Fischer & Porter Co., 830 Jacksonville Rd., Hatboro, Pa.

Gearmotors

Bulletin describes the company's new line of gearmotors featuring integral power units with single, double or triple speed reduction. Another feature is the oil seal between gears and high-speed bearing which is designed to lengthen the bearing life by sealing off abrasive matter. The folder contains a large cutaway drawing showing the parts of the gearmotor in detail.

Manufacturer—Elliott Co., Crocker-Wheeler Div., Ampere, N.J.

Humidity Conditioning

Currently featured in the latest issue of *The Humidity Engineer* is an article on the results of the air conditioning system installed at the Auto Specialties Mfg. Co. of Hartford, Mich. According to the article, absenteeism has been reduced to less than 1 percent. Other articles in this latest issue deal with control of marine condensation and the moisture problems encountered in the various steps of lithographic platemaking.

Copies are available by writing to the editor, *The Humidity Engineer*. Surface Combustion Corp., Toledo 1, Ohio.

Industrial Thermometers

Bulletin E-2 presents technical data on mercury-in-glass and bimetallic thermometers. Included also is a complete listing of thermometers for installation in ducts, piping, pressure vessels, etc. A center spread features thermometers of the separable socket type and dimensioned sketches of all standard sockets for selection. Also discussed is the use of the mercury-in-glass thermometer as a thermal protective device.

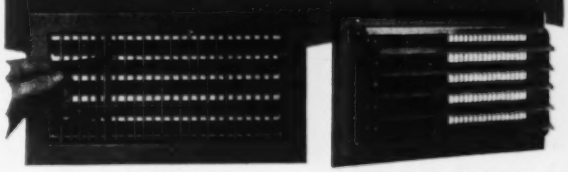
Manufacturer—Precision Thermometer & Instrument

You can get

DIRECTED AIR FLOW

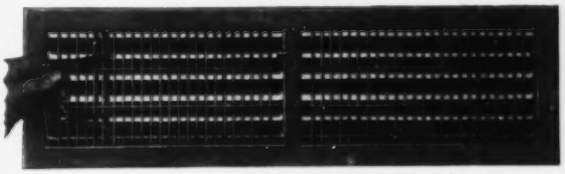
at any angle with

INDEPENDENT "Fabrikated" AIR CONDITIONING REGISTERS



321-A HMV — Rear View Showing "HMV" Valves

Every grille bar adjustable individually—before or after installation



321-A HMV Tandem

Any direction of air flow—right, left, up, down and any combination—is easily obtained with "Fabrikated" Style No. 321-A HMV air conditioning registers, for residence or commercial installations, on sidewalls or ceiling. The face bars are adjustable to right or left; valves on the back are adjustable to direct the air flow up or down; valves may also be fully closed, and are connected to open or close in unison.

The angles of deflection and the combinations to be had are practically unlimited. Adjustments for directed air flow may be made before or after installation. Grille bars are held firmly in place and will not vibrate or rattle.

"Fabrikated" registers are available in sizes from 8 x 4" to 48 x 24", including tandem style. Special sizes can be made without special die set-up charges.

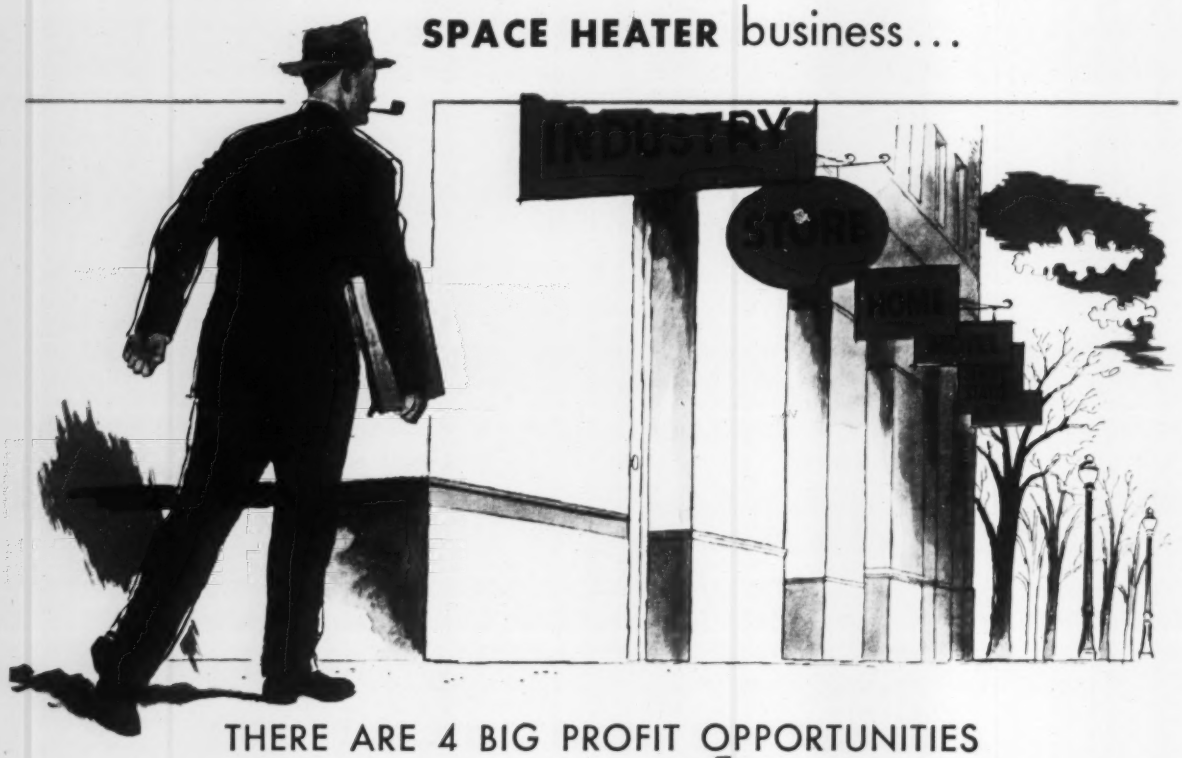
Write for Catalog No. 52.

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET · CLEVELAND, OHIO

when you go after the **UNIT** and **SPACE HEATER** business...



THERE ARE 4 BIG PROFIT OPPORTUNITIES WITH bryant

Here are four Bryant units that have what it takes to turn quick profitable sales:

1. ***The 327 Unit Heater***—the smallest unit in relation to capacity on the market today! Its small size and light weight make it less costly to install. Improved design provides quiet operation . . . more comfortable heat because fan starts only after element gets warm. It's a superior unit at a competitive price. And there are sizes for every requirement.

2. ***The 428 Space Heater***—a fan circulating heater with the one big feature that other units lack—*no forward air-blast*—the result of an exclusive, patented front that gently diffuses warm air. It's quiet . . . it's attractive . . . it really sells.

3. ***The 426 Radiant Circulating Heater***—a smartly styled console-type heater that offers new benefits in comfort and safety. It's available in four sizes, all A. G. A. approved for all gases.

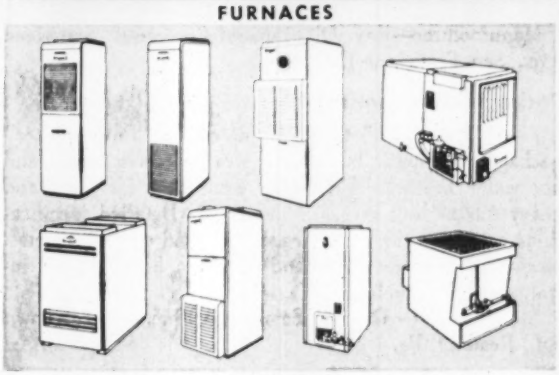
4. ***The 401 Radiant Panel Heater***—a slim, trim radiant circulating heater that mounts on the wall. It installs easily. There's no need to cut floors or carpeting. And it's fully "flame-protected" from children's hands.

For more details call your Bryant distributor or write: Bryant Heater Division, Affiliated Gas Equipment, Inc., 17825 St. Clair Avenue, Cleveland 10, Ohio.

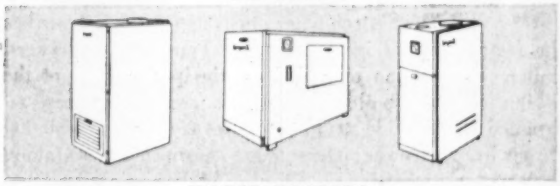
Profit with the name that everybody knows...

THE MOST COMPLETE LINE OF HOME CONDITIONING EQUIPMENT IN THE INDUSTRY

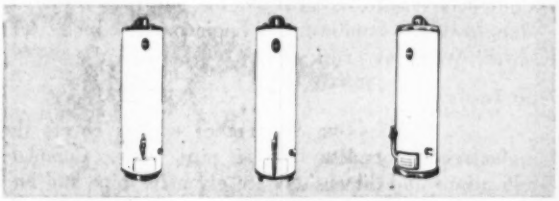
FURNACES



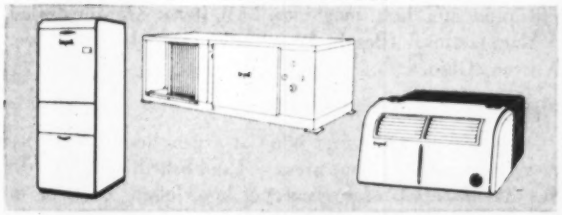
BOILERS



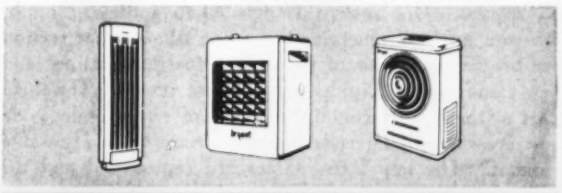
WATER HEATERS



AIR CONDITIONERS



SPACE HEATERS



bryant®

Co., 1434 Brandywine St., Philadelphia 30. Requests for copies should be directed to the attention of W. D. Laverell, Sales Manager, Dept. E-2.

Insulation Protection

This revised reference manual is designed as a companion to Foster Specifications and describes in detail 36 coating and adhesive products for use in the installation and protection of industrial insulations. Technical data, recommended uses and appropriate specifications are given with descriptions of the products. Requests for copies of the manual should be made on company stationery.

Manufacturer—Benjamin Foster Co., 4639 W. Girard Ave., Philadelphia 31.

Low-Voltage Control System

Bulletin GEA-3856 contains more than 35 pictures to describe the construction, installation and protective features of "Cabinetrol," a low-voltage control system. Reference and selection charts on the 24 and 40-in. deep models are included for squirrel-cage, synchronous, and wound-rotor motor controls as well as for lighting panelboards, lighting single-phase circuit transformers, incoming-line and feeder units, and for automatic throw-over units. Dimension diagrams are shown.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

Lubrication Guide for Couplings

A new lubrication guide for dihedral couplings has recently been published. Grease specifications involving high adhesive and extreme pressure additives have been developed in cooperation with leading oil companies having wide national and local distribution.

Published by—Ajax Flexible Coupling Co., Inc., Westfield, N.Y.

Miniature Indicator

Construction, installation and design features of a remote miniature indicator are described in this bulletin. Photographs show the construction of the bellows spring assembly of the pneumatically operated "Ratographic" instrument. The bulletin explains incorporation of the various types of warning devices in the instrument. Also covered is the method for setting up a control transfer station both to monitor a process variable and to reset the controller regulating a diaphragm motor valve. Space requirements for panel mounting are given as well as specifications for range of operating air pressures, scale types, graphic color guides or alarms, accuracy and alarm switches.

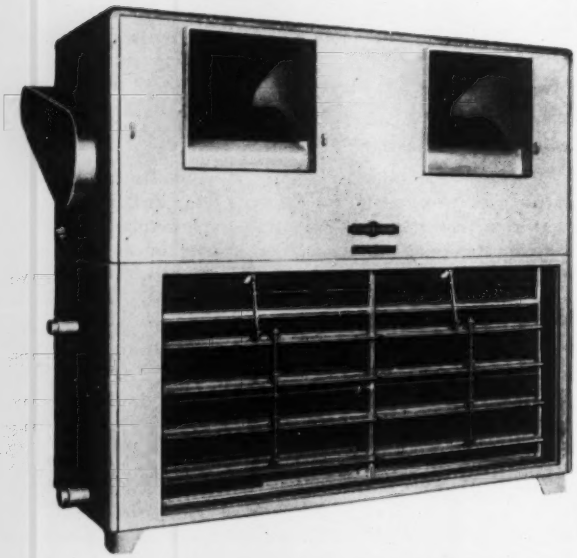
Manufacturer—Fischer & Porter Co., 11A Jacksonville Rd., Hatboro, Pa.

Multi-Purpose Ceiling Report

A report, "Performance Curves," on the company's multi-purpose ceiling has recently been published. This ceiling provides radiant heating, radiant cooling and acoustical control. The report contains nine full-page graphs showing heating capacity curves for combined radiation and natural convection, effective ceiling panel surface temperature, calculated upward heat flow, and other information revealing performance.

Manufacturer—Burgess-Manning Co., Architectural Products Div., 5970 Northwest Highway, Chicago 31.

Govern air conditioning costs...



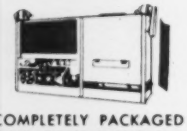
with GOVERNAIR!

Governair keeps costs under control — as well as giving you *governed air!*

The Governair fan and coil cabinet unit shown above is a deluxe component of high quality air conditioning systems that employ directly expanded refrigerants or chilled water. A large capacity air handler especially designed for installations where space limitations exist. Heating is accomplished by the use of steam or hot water.

For the answer to your air conditioning costs and problems, call on Governair — *the *originators of packaged air conditioners!*

AIR CONDITIONERS

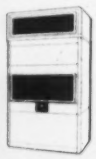


COMPLETELY PACKAGED AIR CONDITIONERS*

BLAST COILS FOR HEATING & COOLING

*Type SCU Conditioners — Patent No. 2,297,928

GOVERNAIR



TYPE SC CONDITIONERS

Governair Corporation, 513 N. Blackwelder, Oklahoma City, Okla.

Oil Burners

A condensed 16-page catalog illustrates and describes commercial and industrial oil and combination gas-oil burners including: fully automatic, semi-automatic and manually controlled horizontal rotary and steam turbine drive burners; commercial and domestic pressure atomizing types for oil, gas or combination gas-oil. Specifications and capacities are included as well as a selection chart.

Manufacturer—Ray Oil Burner Co., 1301 San Jose Ave., San Francisco 12.

Packaged Automatic Boilers

Bulletin 1219 describes "Powermaster" packaged automatic boilers for steam process, steam and hot water heating. The firing equipment for light and heavy oils as well as gas is described. Detailed specifications are given for the boiler, burner and control systems. Drawings, cutaway views and photographs of typical installations are included.

Manufacturer—Orr & Sembower, Inc., Morgantown Rd., Reading, Pa.

Packaged Boiler

Sixteen-page illustrated catalog describes the features of the company's new Type "VP" packaged boiler. One section outlines the principal features of the design of these boilers, which are completely shop assembled and provide steam capacities from 4000 to 30,000 lb per hr. Space requirements are shown in a table, along with typical specifications. A concluding section describes the automatic control system for the units.

Manufacturer—Combustion Engineering, Inc., 200 Madison Ave., New York 16.

Pipe Tools

Eight-page reference catalog covers the manufacturer's complete line of pipe tools. Complete specifications and dimensions are given for pipe and bolt threaders, square and sawing vises, pipe reamers, cutters, and pipe and bolt machines. All items are illustrated.

Manufacturer—Beaver Pipe Tools, Inc., 310 Dana Ave., Warren, Ohio.

Piping Design

The first issue of a new house organ has recently come off the press. Established "to improve the dissemination of engineering knowledge," it is of interest to piping engineers and designers and is available on request. One section is devoted to a description of the company's products and services. In another section are brief descriptions of recent technical publications and new standards for piping and pressure vessels. The third part of the booklet contains a digest of recent boiler code and pressure piping code actions pertaining to allowable stresses. The new stress tables are reproduced and the basis on which they were prepared is outlined.

Published by—Taylor Forge & Pipe Works, P.O. Box 485, Chicago 90.

Powder-Actuated Tools

Applications manual for the powder-actuated fastening system shows how the tools and fasteners are best employed in various installations. The manual lists the specifications on more than 20 fixtures and acces-

sories and 56 drive pins and threaded studs which make up the fastening system. Selection tables setting forth the proper type of fastener and the proper powder charge for various receiving materials are included as a guide. The tools are employed to fasten steel to steel, steel to concrete, wood to concrete or steel, and both nail-like drive pins and internally or externally threaded studs are used.

Manufacturer—Ramset Div. of Olin Industries, Inc., 12117 Berea Rd., Cleveland 11.

Psychrometric Thermometers

Catalog 12-A-20 describes the installation and application of pairs of fluid-filled temperature elements for indicating and/or recording relative humidity. Advising on installation of natural circulation, blower circulated and porous sleeve psychrometers for both open and closed systems, the catalog includes a psychrometric table for use in interpreting dry and wet bulb readings to values of relative humidity.

Manufacturer—Fischer & Porter Co., 819 Jacksonville Rd., Hatboro, Pa.

Scaffolding Frame

Form DF-1 describes the specifications and uses of the "155-x" demountable end frame for special scaffolding applications. Designed to pass through narrow openings in boilers, water tanks and into other confined spaces, the frame is available in widths varying from 3 to 5 ft. It incorporates such features as the "Speedlock" assembly, built-in ladder, floating built-in coupling pins and pivoted cross braces.

Manufacturer—Waco Mfg. Co., Dept. KP, 3565 Wooddale Ave., Minneapolis 16.

Sump Pump

Circular No. 12 describes the new "109" all-purpose sump pump. The brochure illustrates details of construction with cross section illustrations of the pump and switch. Working principles of the pump and switch operation are detailed in a series of drawings, showing each phase of operating control. According to the manufacturer, the new pump features an improved liquid level control switch and incorporates features for greater simplicity and longer switch life.

Manufacturer—Kenco, Inc., 1125 N. Ridge Rd., Lorain, Ohio.

Welded Floats

Bulletin No. 753 features welded floats of stainless steel, monel and chrome plated steel in spherical, elliptical and cylindrical shapes. Included are price lists, weights, buoyancies and collapsing pressures.

Manufacturer—W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa.

Welding Procedures

Data card TDC-155, "Summary of Recommended Arc Welding Procedures for Various Steel & B&W Croloy Combinations," outlines details to be observed in joining similar and dissimilar alloys by arc welding. It covers carbon, intermediate chromium molybdenum alloys steels and stainless steels and outlines the electrodes to be used and suggests the preheating and postwelding heat treatments.

Manufacturer—Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.

Therm-O-Tile

REG. U.S. PAT. OFF.

Underground Steam Conduit

Some Typical Examples.

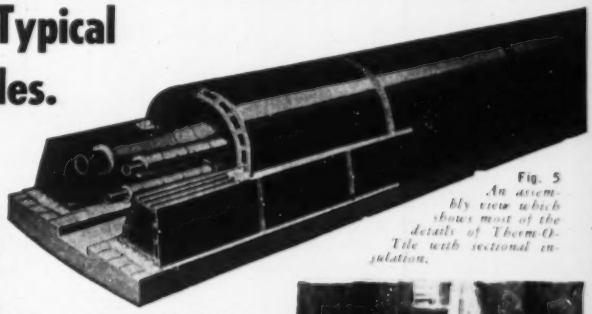


Fig. 5 *An assembly view which shows most of the details of Therm-O-Tile with sectional insulation.*

Of the many hundreds of successful Therm-O-Tile Installations for conveying underground steam to innumerable institutions and industries we are herewith showing four as being typical.

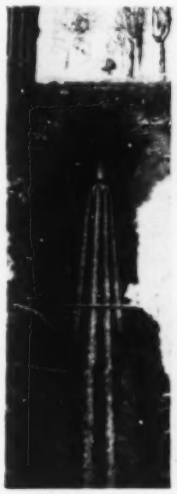


Fig. 1 — *Above. For a prominent hospital in New Jersey. Filler type insulation is used here.*

Fig. 2 — *Below. For a prominent hospital in Maryland. Sectional insulation is used.*

Fig. 3 — *For a well known college in Pennsylvania.*

Fig. 4 — *For a financial building in Washington, D.C.*

Therm-O-Tile is the simplest, strongest, most efficient and most economical. It is PERMANENT, for which reason it is most economical. The solid concrete base and the tile covering cannot decay. The channel drain in the concrete base assures dry insulation at all times.

JOHNS-MANVILLE. Sold and installed by Johns-Manville Technical Service Units in all principal cities.

Ask for Bulletin 511.

H. W. PORTER & CO., INC.

822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.

BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

Insulation Engineers & Contractors

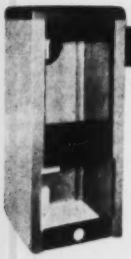
CUSTOM BUILT— QUANTITY PRICED

atlas BOILER JACKETS

YES, Atlas combines highest quality with lower costs by using basic styles and eliminating tooling costs. You can get boiler jackets custom built to your specifications from ATLAS at prices that will surprise you. ATLAS offers three flush type boiler jacket styles to meet manufacturers' demands. All are of heavy gauge steel, with baked enamel finish, ready for quick installation. You'll find them all the last word in appearance and value.

ECONOMY

Square type construction is featured in this model. In spite of its fine appearance Economy is competitive in price. Ideal for large scale housing projects where price is a major factor.



QUALITY

The richness of the round-cornered top is combined with the simplicity and economy of the square-cornered body. This style is competitive in price with all standard construction designs.

DELUXE

This fully round-cornered design is Deluxe in every way. The full radius on all corners lends massiveness and beauty to its expensive appearance. Use Deluxe for your select dealer trade at surprisingly low cost.

Atlas also manufactures cabinets for heating, cooling and air conditioning units, and furnace cabinets of any style. We will be glad to quote cost estimates on any type of boiler jacket or cabinet on receipt of your specifications and requirements.

Atlas **MANUFACTURING COMPANY**

EUSTIS AT ROBBINS ST. • ST. PAUL 4, MINN.

WE HEAR THAT . . .

FARR CO. has announced the opening of *AIR FILTER SALES and SERVICE*, Nashville, Tenn., owned and operated by *HORTON F. EARLY*. This is the fifteenth certification and approval of a "Far-Air" certified filter service organization. The Farr Co. has tentative plans for opening an additional 10 agencies during the balance of 1953 and will complete its national program the first part of next year by adding approximately 16 more services.

Formation of the *BRYANT INDUSTRIAL PRODUCTS CORP.* and its purchase of the principal assets and production facilities of the Bryant Industrial Div., Affiliated Gas Equipment, Inc., has been announced by *ROBERT M. BUCK*, president of the new Cleveland firm. The company, specializing in the design, production and marketing of industrial gas combustion equipment, is located at 17700 Miles Ave. All key personnel of the former Affiliated Gas Equipment division have joined the new organization.

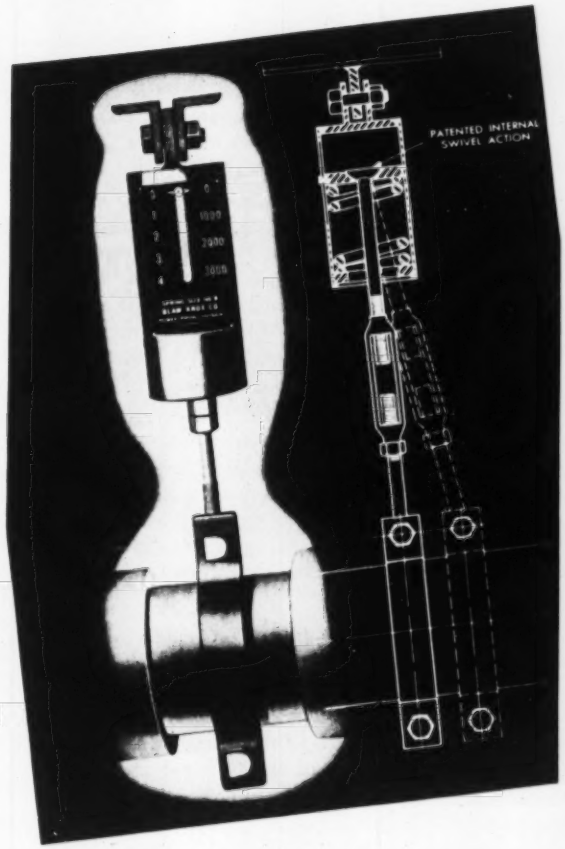
Operating models of auto and home air conditioning equipment were featured by the *DU PONT's* "Keep Cool with Chemistry" show recently at Atlantic City, N. J. Highlight of the exhibit was a 1953 Packard "Patrician" sedan equipped with an air conditioning system that keeps the inside temperature in the automobile in the 70's even when the outside temperature is around 100 F. The equipment, typical of that available on many cars, also assures a constant change of filtered, dust-free air within the car.

The American Ventilating Hose Co., a division of Callahan Zinc-Lead Co., Inc., has changed its name to *THE FLEXAUST CO.* to better identify itself with its product.

The *STANLEY ENGINEERING CO.* has opened offices at 327 S. LaSalle St. to provide consulting engineering services in the Chicago area. The main office will continue to be located in Muscatine, Iowa. In charge of the new office is *FRANK W. EDWARDS*, formerly director of Civil Engineering at the Illinois Institute of Technology.

A new name, "Weathertron," and a new science, "Weathertronics," is being used in describing *GENERAL ELECTRIC's* heat pump and the company's activities in the heat pump field. The new names were selected from suggestions submitted by the employees and a prize was awarded to the winner. In conjunction with the change in name for the heat pump, what was previously known as the Heat Pump Dept., now will be known as the Weathertron Dept.

The *NATIONAL RADIATOR CO.* has inaugurated a program designed to assist students who wish to become engineers but do not have scholarship help and cannot afford a college education. To initiate the new program, the company has chosen two high school graduates in Johnstown, Pa. The firm will pay the tuition costs for the two boys for the four years they are in college. Also in-



"Ready-Made" for Any Piping Layout

To save engineering time and eliminate expensive cutting, threading and assembling in the field, just specify—

BLAW-KNOX HANGERS

Whether the installation calls for Rigid Hanger Assemblies, Functional Hangers, Vibration Eliminators or Overhead Roller Assemblies, you'll find each furnished as a complete unit designed to do the best job. Blaw-Knox pioneered in this field and has brought to it many improvements in hanger design—including the patent Internal Swivel Action which permits both lateral and longitudinal movement, while the hanger case itself remains vertical. Engineers who have solved some of the toughest hanger problems are available at all times to apply their experience to any installation that presents difficulties.

For complete technical data and time-saving information on hanger locating, send for Catalog No. 51.

BLAW-KNOX COMPANY
POWER PIPING AND
SPRINKLER DIVISION
PITTSBURGH 33, PA.

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DRAYER-HANSON

SPOTAIRE

REMOTE AIR CONDITIONER

Quiet beyond belief!

The Spotaire HRC Series individual room unit air conditioner that heats and cools is engineered for concealed installation and designed to function efficiently without noise...so quiet that it's beyond belief. Just check all the advantages offered by the Spotaire Air Conditioner.

The Spotaire VRC Series (also illustrated) surpasses all other floor mounted individual room air conditioners in appearance and quietness of operation.

- **Heats or cools, ventilates, filters and dehumidifies.**
- **Individual room control for convenience, comfort and economy.**
- **Lower operating and installation costs over other systems. Also eliminates costly ductwork.**
- **For residential or commercial applications.**
- **No floor space required.**

Long established in commercial refrigeration and air conditioning, Drayer-Hanson offers a complete line of air conditioning and commercial refrigeration products.

Write for details and catalog.

Limited number of territories available for qualified manufacturer's representatives

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cluded are books, laboratory fees and necessary living expenses. During the summer months the engineering students will return to National Radiator for practical training in the research laboratory.

The *SAUER CO., INC.*, one of the largest heating, ventilating and plumbing contractors in the Columbus, Ohio, area is being merged with *LIMBACH CO.*, a contracting organization of Pittsburgh. The Columbus firm also will be known as the Limbach Co. *JOSEPH ZELLAK*, president of Sauer, will continue as executive head at Columbus.

The *DeVILBISS MFG. CO., LTD.*, Canadian subsidiary of the DeVilbiss Co., Toledo, will shift manufacturing operations from Windsor, Ont., to a new $600,000 plant at Barrie, Ont. about December 1. The move to Barrie will give the company increased manufacturing facilities and will provide for the consolidation of manufacturing and general offices in one building. *GEORGE V. JACQUEMAIN* is president of the Canadian subsidiary.

A new motion picture "Resistance Welding of Stainless Steel" has just been released. It discusses spot welding, seam welding, projection welding and butt welding. It is a 16mm sound and color film, making use of animation and drawings to clarify the regular picture material. It is available on free loan from *ALLEGHENY LUDLUM STEEL CORP.*, 2020 Oliver Bldg., Pittsburgh 22.

Construction has started on a new plant of the *ALLOY RODS CO.* in El Segundo, Calif. The new plant, situated near the Los Angeles International Airport, will be known as the Pacific Coast Div. of Alloy Rods Co. The plant, which is expected to be in full operation by October 1, will be under the supervision of *GEORGE M. HOHMANN*, the production manager of the York, Pa. plant.

TUBE DISTRIBUTORS CO., INC., suppliers of commercial and aircraft alloy stainless and carbon steel tubing and boiler tubes, has moved its general offices, stock and heavy equipment from its former site in Brooklyn, N. Y., to new air conditioned offices and warehouses recently completed in Garden City, N.Y.

COMBUSTION ENGINEERING, INC. has established a Nuclear Power Div. This division will be headed by *DAVID M. SCHOENFELD*, who has been in charge of engineering relative to controlled circulation boilers and marine boilers. The company presently is occupied with several projects having to do with the development of equipment for nuclear power generation.

First prize for the best trade show exhibit of the year has been awarded to the *TRANE CO.* for its exhibit at the American Society of Heating and Ventilating Engineers convention last January. The award was presented to *FERDINAND SONTAG* of the Trane Advertising Dept. at the recent conference of the National Industrial Advertisers Assoc.

for Air Conditioning • Heating • Ventilating • Water Piping

you need

ROCKWELL VALVES

For Air – Gas – Liquids – Solids

W. S. Rockwell standard butterfly valve with air diaphragm operator, declutching mechanism and handwheel.

W. S. Rockwell wafer type butterfly valve with hand lever control.

For uniform, quick control and shut-off, manually or automatically—

For minimum pressure drop when valve is fully open—

You're sure, you're safe with Rockwell butterfly or slide valves—always dependable.

TIGHTNESS—commercial, air- or drip-tight.
CONSTRUCTION—as required.
PRESSURE—to 300 p.s.i.
TEMPERATURE—as high as 2000° F.
CONSTRUCTION—of any metal or rubber-lined.
CONTROL—lever, hand or chain wheel, air diaphragm or cylinder, electric motor, solenoid, etc.
SIZES—from 1" to 120" pipe diameter.

W. S. Rockwell standard slide valve with pull handle; available also with hand lever, handwheel or chain wheel.

Get our Valve Catalog

ROCKWELL SINCE 1888 BUILT

W. S. ROCKWELL COMPANY

2543 ELIOT STREET • FAIRFIELD, CONN.

It's Automatic!
It's Accurate!
It's Dependable!
It's Self Operated!
It's the LOW PRICED
TEMPERATURE REGULATOR

- SIMPLE, RUGGED, LOW COST, FIELD-REPLACEABLE THERMOSTATIC SYSTEM
- TIGHT SHUT-OFF; Self aligning single seated construction insures tightness.
- SUPER-POWER INSTANTANEOUS RESPONSE; Liquid expansion, throttling action, insures positive, constant control.
- OVERLOAD PROTECTION
- EXTREMELY COMPACT AND STURDY

Write for Bulletin ST-162 Today

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STĀCON CORP.
400 Commercial Ave., Palisades Park, N. J.
AFFILIATES
FARRIS ENGINEERING CORP.
FARRIS FLEXIBLE VALVE CORP.
FARRIS HYDROTORQUE CORP.
FARRIS HYDROSEAL CORP.

No longer is it necessary to invest in dual fuel to utilize gas.

just Add gas!

. . . . . **WEBSTER'S REVOLUTIONARY PACKAGED RECTILINEAR* GAS BURNER**

The Packaged Rectilinear makes four inches pressure do the work of four pounds with fractional horsepower.

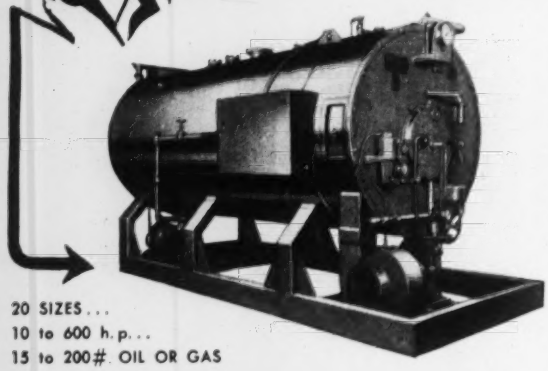
You can fire gas — automatically — through any narrow opening without disturbing your present firing equipment — hand or stoker fired coal, oil or whatever it may be.

*TRADEMARK

Write for Literature

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION Toledo, Ohio

No Annoying "Extras"
IT'S READY TO INSTALL
AND START MAKING
Low-Cost Steam!



20 SIZES...
10 to 600 h.p...
15 to 200# OIL OR GAS

AMESTEAM GENERATOR

This automatically controlled packaged boiler unit includes:

★ all piping and wiring, ready for your service connections.

★ fan, feed water pump, condensate tank, injector, blow-off valve, necessary refractories, insulation and metal jacket.

ALL YOU NEED is fuel tank, gas vent and service connections.

—AND YOU KEEP RIGHT ON SAVING with these trouble-free, fully automatic units with their eye-level controls, their accessibility inside and out, and fuel-saving 80% guaranteed efficiency!

FOR FACTS ON LOWER COST STEAM WRITE FOR THIS FREE BULLETIN NOW!

NAME.....
COMPANY.....
ADDRESS.....

AMES IRON WORKS

BOX D-93 OSWEGO, N. Y.

Builders of Better Boilers Since 1848

WHO'S WHAT...

ZONOLITE CO. has announced appointment of *W. R. COLLINS* as manager of the newly formed *ZONOLITE CONTRACTORS, INC. HOWARD P. TIEMANN* will be the sales engineer for the new firm. Headquarters are at 135 S. LaSalle St., Chicago.

The board of directors of *ACME INDUSTRIES, INC.* has announced the appointment of *PETER W. WEATHERWAX* as vice president and *FRANK M. REED* as secretary-treasurer. Mr. Reed was formerly controller and assistant secretary-treasurer. Mr. Weatherwax, formerly secretary-treasurer, will also function as assistant to the president.

WILLIAM G. GERSTACKER has been appointed chief engineer of the *HEIL PROCESS EQUIPMENT CORP.* Other recent additions to the staff include the appointment of *JOHN M. CARPENTER* as estimator in the lining and coating department and *FRANK BABIK* as estimator in the fabrication department.

MAGNEX CORP. has appointed *JOSEPH B. HERSH* as plant manager of the corporation. Mr. Hersh was formerly chief engineer and general manager of both David Bogen Co., Inc. and Utility Electronics Corp.

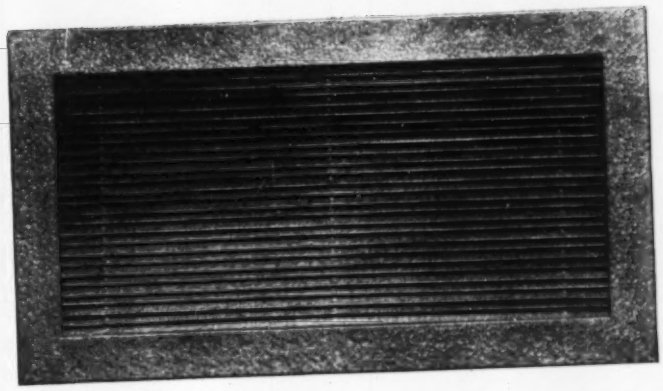
JOHN CLARKE, author of a number of articles which have been published in *Heating, Piping & Air Conditioning*, is now associated with the *VISKING CORP.*, Chicago, as a member of the home office engineering staff. He will act as consultant and be responsible for the engineering of heating, ventilating and refrigeration work for all divisions of the company.

WALTER BARTEL has been named general sales manager of the *C. E. SQUIRES CO.*, Cleveland. Mr. Bartel has just completed 15 years as manager of utility sales and public relations director of the Ric-Wil Co.

ARMOUR RESEARCH FOUNDATION of ILLINOIS INSTITUTE OF TECHNOLOGY has announced the appointment of *LOUIS L. SANTORO* as superintendent of plant facilities. Mr. Santoro will supervise maintenance, construction, plant protection, safety and custodial operations.

JAMES G. KINTNER has been named vice president in charge of engineering of the *AMERICAN DISTRICT STEAM CO., INC.* He has been chief engineer since 1950.

JOHN A. MARSH has been elected vice president of the *INTERNATIONAL NICKEL CO., INC.* Mr. Marsh became associated with the company as a laboratory assistant in the Huntington works in 1928 and was appointed as assistant to the vice president in general charge of all plant operations in the United States in 1947, the position which he now holds.



- CUTS INSTALLATION TIME OVER ½!
- EASY TO INSTALL *Anyone Can Do It!*
- COMPLETE—NO WOOD MOLDINGS TO ADD!

NEW! THIN CORE GRILLE FOR DOORS – PARTITIONS ¼" to ¾" THICK!

First Grille ever designed specifically for thin doors and partitions. Anyone can install it in just a few minutes time. No close tolerances required . . . almost a half-inch extra on sides for positioning. Telescoping auxiliary frame fastens to grille with posts and screws. Clamps tight. No holes to position. Practically no danger of ruining door. No wood moldings. All steel. Rattle-proof. No vision, with 80% free area. Available with or without frame, all sizes. Gray or tan prime coated, or Hammertone finish in gray or bronze.

→ **ACTUAL SIZE Cross Section**

WRITE FOR OUR COMPLETE
FREE CATALOG
Listing Over 1000 Types and Sizes of Grilles for Every Requirement

A-J MANUFACTURING CO.
Dept. H9 - 2119 Washington St. - Kansas City, Mo.

A wide choice of SPRAY NOZZLES for heating & ventilating systems

Whatever the application...humidifying, atomizing, cooling or others...Binks offers you one of the most complete selections of spray nozzles produced anywhere...and each nozzle is specifically designed for the service intended.

You get fine fluid break-up with minimum pressure. No internal restrictions to restrict flow. You get long nozzle life. Heaviest metal cross-section at points of greatest erosion. You have a choice of nozzles cast or machined from brass or special corrosion-resistant metals. For complete data, write Binks Manufacturing Co., 3118-38 Carroll Ave., Chicago 12. Or mail coupon.

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EVERYTHING FOR WATER COOLING

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40-page Catalog 5200 contains dimensions, spray angles, capacities, cutaway drawings...in fact, everything you need for nozzle specification or selection. And it's FREE...just mail coupon.

Mail coupon today for your FREE Catalog

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3118-38 Carroll Ave., Chicago 12, Ill.
Gentlemen: Please rush me a FREE copy of your Spray Nozzle Catalog 5200.

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A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

REPRESENTATIVES IN ALL PRINCIPAL CITIES • SEE YOUR CLASSIFIED PHONE DIRECTORY

WATERMAN-WATERBURY CO. has appointed *F. W. LEGLER* a vice president of the company. Mr. Legler is manager of the New England division. He has been with the company since 1919. His headquarters now are in South Boston, Mass.

The *SCHAIBLE CO.* has appointed *STEPHEN H. BADGETT* as vice president of manufacturing. Mr. Badgett was formerly associated with the Pressed Steel Car Co. as director of engineering and works manager at McKees Rocks, Pa.

CARL W. LARSON has been appointed to the products engineering department to work on the development of new air conditioning and heating products for the *TRANE CO.*

WORTHINGTON CORP. has appointed *O. B. WERT* as manager of the technical data and training section of the air conditioning and refrigeration division of the company. Mr. Wert will be responsible for preparation of educational material and the operation of training courses for the firm's personnel.

CLEAVER-BROOKS CO. has announced several new appointments. *FRED KRUGLER* has been named plant superintendent. He was formerly supervisor of assembly and is succeeded by *GEORGE SEMRAU* in that position. *CHESTER SELLIN* is boiler fabrication supervisor and *EDWARD HAHN* is supervisor of fabricated components.

I. MELVILLE STEIN is the newly elected president of *LEEDS & NORTHRUP CO.* Mr. Stein was formerly executive vice president and succeeds *CHARLES S. REDDING* who, after 14 years as president of the firm, is now chairman of the board.

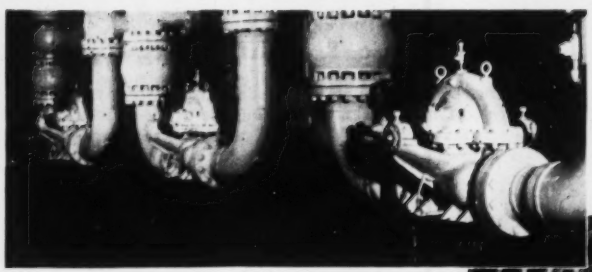
Other changes in management were also announced. *D. H. SCHULTZ* succeeds Mr. Stein as executive vice president and also retains his duties as treasurer. *GEORGE W. TALL, JR.*, vice president, is also secretary of the company.

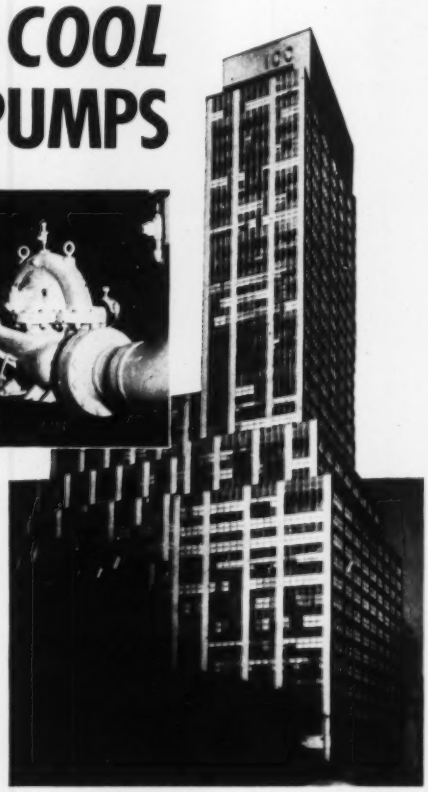
ROSS J. MARTIN and *JOHN C. MILES* have been promoted to professors in the department of mechanical engineering of the *UNIVERSITY OF ILLINOIS.*

PEABODY ENGINEERING CORP. has appointed *JOHN DUNN* as general sales manager. Mr. Dunn was formerly in charge of burner sales. His new position will include full responsibility for all sales divisions in the western hemisphere and territorial representative companies. He has been with the company since 1935.

The *MEYER FURNACE CO.* has announced the appointment of *WILLIAM A. COOK* as dealer sales manager and *J. G. CALHOON* as assistant sales manager. Mr. Cook will have charge of an expanded program of sales

100 Park Avenue *KEEPS COOL* with AMERICAN-MARSH PUMPS





To circulate chilled water in the air conditioning system, these American-Marsh Pumps are used in the 100 Park Avenue Building, New York City. Bronze fitted and directly connected to 150 HP motors, they have a capacity of 2,000 GPM.

In almost continuous operation for about three years, they have performed their vital job with excellent satisfaction. American-Marsh can satisfy your pumping needs, too.

WRITE FOR DETAILS
stating size and type of pumps that interest you most.

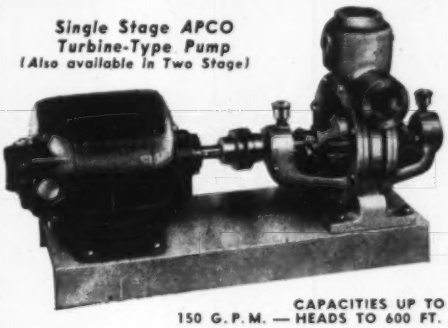
AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN
In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

YOU CAN'T BEAT APCO TURBINE-TYPE PUMPS FOR BOILER FEED

Specify Apcos because they have "What it Takes"

Apco Pumps will do a better job for your customer friends

Single Stage APCO Turbine-Type Pump
(Also available in Two Stage)



CAPACITIES UP TO 150 G.P.M. — HEADS TO 600 FT.

You may, with complete confidence, sell — specify — or install APCO on boiler feed duties. APCO pumps are distinguished for their ability to deliver small capacities against high heads with but slight change in capacity or efficiency against drastic head variations. Insure satisfaction with the following array of modern features, found completely ONLY in APCO:

- SIMPLE—WEAR-FREE COMPACT
- HIGH EFFICIENCY
- WILL NOT VAPOR BIND
- HYDRAULICALLY BALANCED
- ACCESSIBILITY
- HIGH SUCTION LIFT (28 ft. at sea level)
- QUIET OPERATION
- HIGH PRESSURE PER STAGE
- DOUBLE SUCTION DESIGN
- PRECISION SHAFTS
- BALL BEARINGS (Support on both sides of Impeller)
- RIGHT OR LEFT HAND OPERATION
- REPLACEABLE COVER PLATES

PUMPS *"by Aurora"* FOR MANY PURPOSES

Among Apco Turbine-Type Pumps and Aurora Centrifugal Pumps are quality units for many purposes. We invite you to acquaint yourself with the wide variety of Pumps "by Aurora." We invite your inquiries and pledge our friendly cooperation.

Write us for Condensed Catalog or Individual Bulletins

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS — AURORA PUMP COMPANY

Subsidiary of the New York Air Brake Co.
80 Loucks St., AURORA, ILLINOIS

For Double BOILER BLOW-OFF *Safety*

These EVERLASTING Duplex Boiler Blow-Off Units are assuring double safety in plants all over the country.

In the unit illustrated above, the left-hand valve is the standard quick-operating EVERLASTING design which opens with a quarter-turn of the lever and closes with a drop-tight seal that actually improves with use. The right-hand valve is an EVERLASTING Angle Valve, stoutly built to withstand shocks and abrasion of blow-down solids.

Below are shown two additional EVERLASTING Duplex Units, each including the EVERLASTING "Y" Valve . . . simple and sturdy in design, with all parts interchangeable with those of the Angle Valve. All EVERLASTING boiler blow-off designs conform with ASME codes, and are available in a range of sizes for pressures up to 600 psig.

Two of the many available combinations of **EVERLASTING** *Boiler Blow-Off Units.*

Write for descriptive bulletin!

EVERLASTING VALVE CO., 49 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF. EV372A

FOR EVERLASTING PROTECTION

EXCLUSIVE
All other manufacturers expand the tube to bond the fins. This practice tends to weaken the tube and often results in tube fracture at the weld. Brown Heavy-Duty Bayce-Heet is made by a new improved process. The fins are beaded onto the tube. No expansion of the tube is necessary. Thus the tube is strengthened and will not fracture.
This exclusive Brown process does more! It provides a perfect bond for most efficient heat transfer. It makes it possible to cut and rethread the tube at any point . . . a welcome advantage when an odd length is needed on the job. No other fintube gives you this advantage.
EASIER TO INSTALL
GREATER EFFICIENCY
32 FINS PER FOOT
10-15% LOWER COST
SAFETY FIRST! Heavier gauge fins with rounded corners guard against cut fingers when installing.
BROWN PRODUCTS COMPANY
FOREST HILLS, NEW YORK
BROWN
BAYCE HEET
HEAVY DUTY
THE NEW LEADER
IN
INDUSTRIAL FINTUBE
ILLUSTRATED LITERATURE ON REQUEST

aids for dealers and will supervise the activities of company engineers who work with the dealers. Mr. Calhoon will direct the sales of non-manufactured items. Previously he was in charge of sales promotion for the firm.

L. H. OPPENHEIM has been named a vice president of the *HENRY J. KAISER CO.* He will continue as assistant general manager of Kaiser Engineers, a division of the parent firm. Mr. Oppenheim has been with the company since 1948.

The *NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOC.'s* board of trustees has voted to retain *LORIN G. MILLER* as technical coordinator of the association. Mr. Miller has retired as the dean of engineering of Michigan State College.

JOHN W. DINLEY has been appointed advertising manager of the *WOLVERINE TUBE DIV.* of *CALUMET & HECLA, INC.* Mr. Dinley was formerly associated with Detrex Corp. He will be located in the firm's general sales office at 1850 Guardian Bldg., Detroit.

The *JOHNSTON PUMP CO.* has elected *KENNETH G. LUNDIE* as president of the Johnston Pump Co. of New Mexico and the Johnston Pump Co. of Fresno. Mr. Lundie was formerly vice president in charge of sales for the company plant in Pasadena, Calif.

JOSEPH F. DEMPSEY has been elected to the *C. A. DUNHAM CO.* board of directors.

HANDY & HARMAN has announced two new appointments. *M. W. TOWNSEND* is now assistant to the president. He was formerly sales manager. *PAUL G. FELD* has been appointed sales manager to succeed Mr. Townsend. He was formerly supervisor of industrial sales in the Chicago territory.

WILLIAM G. HILL has been appointed sales engineer for *GENERAL DYNAMICS CORP.* in the Electro Dynamic Motor and Generator Div. Mr. Hill was formerly employed with George H. Dean, Inc. and the Universal Winding Corp.

BRYANT HEATER DIV., AFFILIATED GAS EQUIPMENT, INC. has announced the appointment of *K. T. DAVIS* as director of engineering and product development. Mr. Davis was previously chief engineer and most recently manager of the sales engineering department.

JEROME TIEGER has been appointed heating and cooling engineer for *HAJOCA CORP.* Mr. Tieger was formerly a heating and air conditioning salesman with the company.

W. G. HARKNESS has joined the sales staff of *THE NORRIS BLANCHARD CO.* of Omaha, manufacturers'

COLE

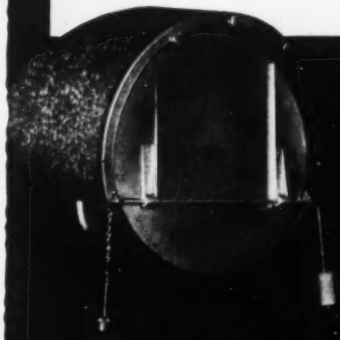
INDUSTRIAL

DRAFT CONTROLS

FOR EVERY NEED — ANY SIZE — ANY SHAPE

Outperform and outlast

ORDINARY CONTROLS



COLE

STANDARD ROUND GATE CONTROL

with or without universal sleeve. Open check type. Perfectly counterbalanced Ball bearing equipped. Stock sizes from 14" to 36". Prices start at $10.83. For top or side mounting. Special sizes on order.

COLE

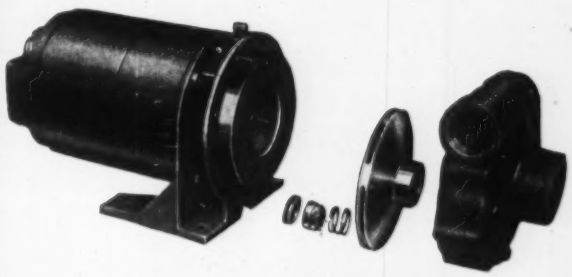
RECTANGULAR DAMPER CONTROL

Saves 10% to 30% on fuel. Internal damper type. Ball bearing equipped and counterbalanced in all positions. Large close fitting blades. All sizes and shapes, for any type breeching. Top or side mounting. Round stock sizes 14" to 36"

COLE-SEWELL ENGINEERING CO.

2288 UNIVERSITY AVENUE • ST. PAUL 14, MINNESOTA

Goulds Fig. 3642 close-cupld centrifugal pump especially designed for air conditioning service. Capacities to 110 GPM. Heads to 120 ft.



Vertically split casing permits you to inspect and maintain pump, or remove motor, adapter and rotating element, without disturbing piping connections.

NEW GOULDS PUMP FOR AIR CONDITIONING

saves space, slashes installation, operating and maintenance costs

COMPACT DESIGN—Fits anywhere. Close-coupled construction requires minimum space. No coupling used.

EASY INSTALLATION—Just bolt the unit down, connect piping and power, and your pump is ready to go. Discharge may be located in any one of eight positions.

QUIET OPERATION—Impeller, the only moving part, is carefully balanced for quiet, vibrationless performance.

NO STUFFING BOX LEAKAGE—Mechanical seal prevents leakage without binding shaft. Requires no adjustment or maintenance.

LONG TROUBLE-FREE SERVICE WITH MINIMUM MAINTENANCE—Sturdy construction and permanent alignment of working parts assure long operating life.

For performance curves, specifications and other pertinent details, get in touch with your nearby Goulds representative, or write direct to Goulds, Seneca Falls, N. Y. for illustrated Bulletin 624-A3.

Goulds PUMPS INC.

Seneca Falls
New York

representatives and distributors. Mr. Harkness formerly was manager of the Heating Dept. of Crane Co. in the Omaha branch area.

IRON FIREMAN MFG. CO. has announced two new executive appointments. *C. C. CRAFT* is vice president and secretary. He was previously secretary and controller and has been with the company 26 years. *HENRY J. MACK*, formerly divisional controller, is now controller.

H. F. BRUNDAGE, who is president of the *BRUNDAGE CO.*, has been recently elected president of the Kalamazoo school board.

THE NATIONAL RADIATOR CO. has announced the election of *LESLIE L. HOTSENPILLER* as vice president of the company. Mr. Hotsenpiller was previously director of manufacturing for the company. He was affiliated with North American Aviation Corp. before coming to National.

BERNARD ALEXANDER has been appointed sales manager of *STERLING, INC.* Mr. Alexander has had over 20 years experience with nationally known firms such as Watts Regulator Co., Milwaukee Valve Co., and Crane Co.

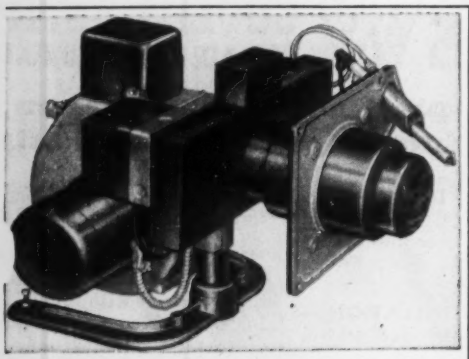
EUREKA WILLIAMS CORP. has announced the appointment of *R. A. SPROAT* as assistant treasurer of the firm. Mr. Sproat was formerly with the Mid West Body and Mfg. Div. of Electrographic Corp.

HOWARD W. JAMES has been appointed advertising and sales promotion manager of the *FLEXIBLE TUBING CORP.* Mr. James will also head the company's distributor sales training program. He was previously general manager in charge of advertising and sales promotion for Ken Paulson Assoc.

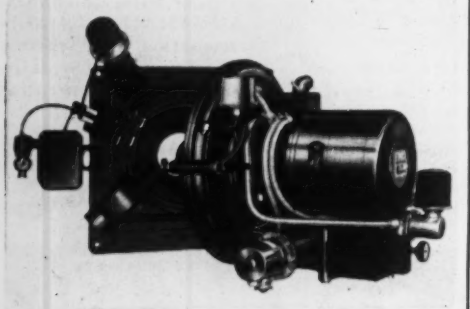
The *TRANE CO.* has announced two changes in its product engineering staff. *CHESTER D. WARE*, who joined the company in 1952, has become a heat transfer specialist in the development of new products. He was a staff engineer at Procter & Gamble for five years before coming to Trane. The second appointment is that of *HENRYK HURWICZ*, who has been named to work on a special heat transfer development project.

RICHARD E. HOIERMAN has been named advertising manager for the Machinery Div. of *DRAVO CORP.* and the *DRAVO-DOYLE CO.*, a subsidiary. Mr. Hoierman succeeds *ROBERT C. BLACK*, who has been transferred to the sales staff of the division's heating department.

RUSSELL J. DICKSON has been appointed general sales manager, *LESCHEN WIRE ROPE DIV.* of *H. K. PORTER CO., INC.* Mr. Dickson will be in charge of the company's sales activities. He has been with Leschen for



BANKHEAT DUAL-FUEL, Pressure Type, 5 to 54 H.P.



MODEL 53 METERING PUMP DUAL-FUEL BURNER
25 to 400 H.P.

The new way to bring heating costs down

INSTALL

JOHNSON *Dual-Fuel* BURNERS

THAT OPERATE AUTOMATICALLY ON EITHER *Oil* OR *Gas!*

In regions where low-cost gas is available part of the time but not available constantly, Johnson Dual-Fuel Burners are an ideal installation. They enable the user to change from one fuel to the other whenever it is advantageous. If gas is available and cheaper . . . he can burn gas. When gas is *not* available, or when oil is cheaper . . . he can burn oil. And all in the same burner. Just a flip of the switch makes the changeover. (For a little extra cost, he may have an Automatic Changeover Switch which is controlled by outdoor temperature or by gas pressure.)

These burners are available in Domestic, Commercial and Industrial sizes and types. All are completely automatic and equipped with the finest electronic controls. They are engineered, tested and precision-built to give lasting service and satisfaction. See them at your nearest Johnson dealer, or write direct.

.....Johnson Oil Burners.....

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
Church Road, Bridgeport, Pennsylvania

For

SCHOOLS • COLLEGES
HOSPITALS • OFFICE
AND PUBLIC BUILDINGS
assure

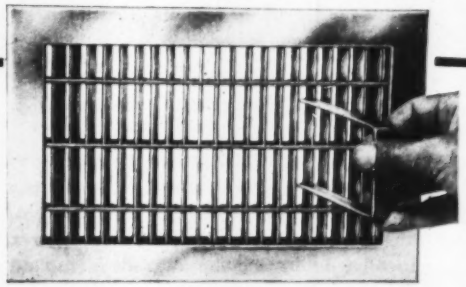
safe, dependable air distribution

with

R & G

*Tamperproof
*Kickproof

REGISTERS and GRILLES

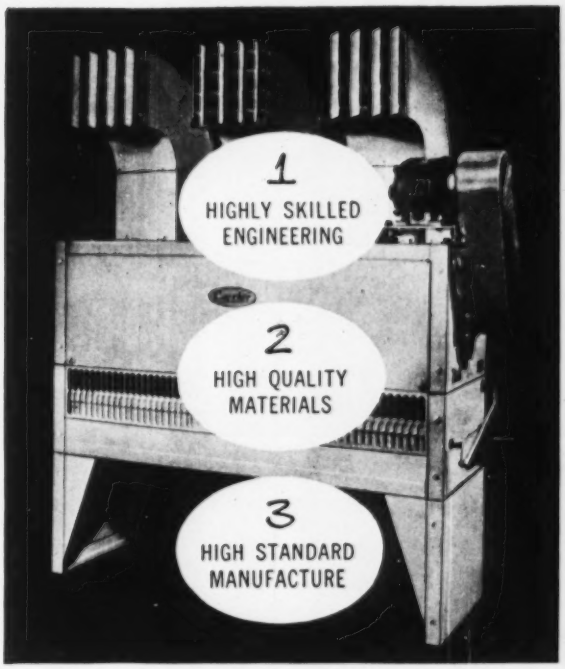


R & G Style 120, Chromium plated, Solid Bars with Interlocking Cross Bars (fixed or adjustable).

***FAULTLESS OPERATION**
***RUGGED CONSTRUCTION**

Complete Line of Registers and Grilles for HEATING • VENTILATING • AIR CONDITIONING
Catalog on Request

REGISTER & GRILLE MFG. CO., INC.
70 BERRY STREET, BROOKLYN 11, N. Y.



They make the difference in

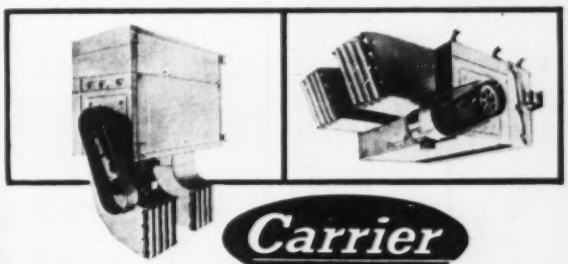
Carrier Heat Diffusers

. . . a difference that is fundamental; that leaves no doubt about the high efficiency, economical operation and long-lasting construction of these extremely flexible and easily installed units.

Compact and sturdy,* Carrier blower-fan type sectional Heat Diffusers are designed and built especially for heating and ventilating large areas in factories, warehouses, garages, hangars, commercial and industrial buildings.

Floor Mounted, *Horizontal Suspended*, and *Vertical Suspended*, as illustrated. Each type in six basic sizes. Capacities from 115,000 to 2,390,000 Btu's. Steam or hot water. Either right or left hand coil connections.

*For example, all sections are rigidly die formed from heavy gauge steel and integrally welded. For complete list of features, specifications, and selection data, write to Carrier Corporation, Syracuse, New York.



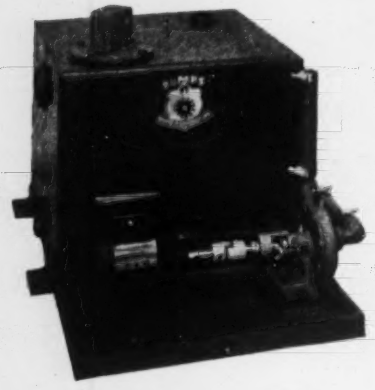
Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

The New Improved

EAGAN "EAGLE"

CONDENSATE PUMP



MATCH THIS FOR VALUE!
Here's the best condensate pump "buy" on today's market. It provides far more capacity than any similar pump . . . 8,000 sq. ft. EDR at 20 PSI . . . and it's only $124.00 (trade price, F.O.B. Phila.)

REDUCED PRICE

Compare These Six Features

IMPROVED DESIGN

- Low inlet, 2" I.P.S., 12" from floor
- All bronze centrifugal pump
- Standard 1/4 HP 115 volt quiet capacitor motor
- Thermal overload protection
- Driplip base of heavy structural steel with 1/2" tapped drain
- Flexible connectors on both suction and discharge of pump, and flexible coupling isolate the pump, preventing pipe cramp and misalignment, which cause wear and noise

OTHER MODELS TO 100,000 SQ. FT. 200 P.S.I.

WALTER H. EAGAN CO., INC.
Mfrs. of Condensate, Vacuum, Turbine, Boiler Feed Centrifugal and Proportioning Pumps
Pump Specialists since 1920

WALTER H. EAGAN CO., Inc. (Dept. B) MAIL COUPON TODAY
2336 Fairmount Avenue
Philadelphia 30, Pa.

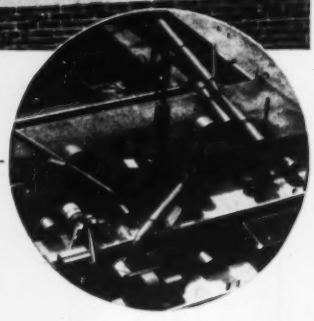
SEND ME FREE DESCRIPTIVE BULLETIN OF THE NEW EAGAN "EAGLE" CONDENSATE PUMP

NAME .....
COMPANY .....
STREET .....
CITY ..... Zone.... State.....

DRY, FRESH -------AIR--------

For a Supersonic

WIND TUNNEL



● New and improved, this NIAGARA METHOD that effectively dries outdoor air for a wind tunnel used for testing at supersonic speed, can be trusted to give you the best air conditions for your purpose:

- to dry your materials or products
- to prevent condensation or moisture damage
- to protect your moisture-sensitive processes
- to give you an atmosphere in which your product can be packaged or stored safely
- to give you exactly the right atmospheric conditions for testing materials
- to put "fresh air" back into your air conditioning, increasing its capacity and effectiveness

The Niagara "fresh air" Method removes the excess moisture from outdoor air by contact with an absorbent liquid in a spray chamber. The liquid contact temperature and the absorbent concentration, both controlled thermostatically, determine the amount of moisture in the conditioned air. Heating or cooling the air is a separate function. Therefore, you can easily and inexpensively have a precisely controlled condition without the use of moisture sensitive instruments.

The Niagara Absorbent Spray Method is noted for solving the really difficult problems of air conditioning. Write for complete information.

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. H.P., 405 Lexington Ave. New York 17, N. Y.

Field Engineers in Principal Cities of U. S. and Canada

more than three years as Chicago district manager.

CHESTER W. BIRCH has been elected controller by the board of directors of the *L. J. MUELLER FURNACE CO.*

IN THE TERRITORIES . . .

For *AIRTEMP DIV., CHRYSLER CORP.* — *ROBERT E. DAVIS* is the new manager of the Dayton regional sales office.

For the *UNITED STATES AIR CONDITIONING CORP.*—A new manufacturer's representative is *NORMAN S. WRIGHT & CO.* of San Francisco, Portland and Seattle.

For *DRAVO CORP.* — *E. G. COUNSELMAN* has been appointed sales engineer for the Machinery Div. in the New York City territory. *D. H. FELIX* is the new sales engineer of the Chicago office located at 208 S. LaSalle St. and *JOHN SCHUSTER* now is at the Detroit offices.

For the *DURIRON CO., INC.* — A new direct sales office to serve the New England area. *R. W. HENZE* is head of the new office.

For *NATIONAL RADIATOR CO.* — *HOWARD W. RUSH* is the new manager of the Washington, D.C. branch sales office. Mr. Rush has been with the firm since 1942. He succeeds *HUBER P. SELTZER* who has been branch manager since 1945 and will continue on the sales staff with special representative duties particularly in the field of government offices and agencies.

For *READING TUBE CORP.* — A new sales representative, *OLESKO AND FISHER*, 330 South St., Rensselaer, N.Y., for the northeastern New York territory from Putnam and Orange north to Franklin and Clinton counties.

For *MAID-O'-MIST, INC.* — *EISBRENNER HEATING SALES*, Peru, Ind., is the representative for the state of Indiana, excluding the seven most southern counties bordering the Ohio River.

For the *RELIANCE ELECTRIC & ENGINEERING CO.* — New engineers for three district sales offices. For Cleveland, *DONALD L. PETERSON*; for Buffalo, *DAVID H. RUSH*; for Detroit; *JOHN E. HARGER*.

For *WESTINGHOUSE ELECTRIC CORP.* — Four new franchises for distributors have been awarded. They have been issued to: *NEW ENGLAND EQUIPMENT CO.*, of Lewiston, Maine, headed by *NIKITAS KESARIS*; *INDUSTRIAL EQUIPMENT & ENGINEERING CO., INC.* of Pittsfield, Mass., headed by *HUGH* and *RAY KIRKPATRICK*; *GAS HEATING CORP.* of Norfolk, Va. headed by *EUGENE SARGEANT*; and *DIXON*

greater efficiency for
Commercial and Industrial
GAS
fired heating plants with
field
"M-G" draft controls

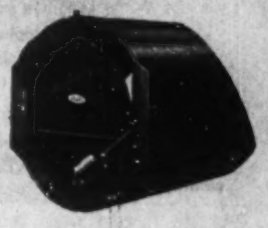
1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

FIELD CONTROL DIVISION
of H. D. Conkey & Company — Mendota, Illinois

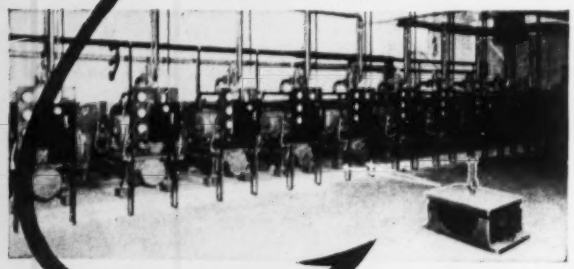
AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division, — Cranes, Hoists

UP-DRAFT VIEW
Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.



DOWN-DRAFT VIEW
Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

STOP VIBRATION



with KORFUND VIBRATION CONTROL

Problem: When erecting a new office building, a prominent refrigeration equipment manufacturer wanted to install 41 of his units in two penthouses. Light-weight flooring with 40 foot spans between columns was planned. Vibration and noise transmission had to be prevented.

Solution: Korfund steel spring Isolators and Elasto-Rib pads completely prevented vibration and noise transmission, eliminated all bolting to the floor, and made economical light-weight floor construction possible.

In Air Conditioning, Korfund Vibration Control has paid off in dollars and cents for thousands of Engineers and Contractors, because Korfund units reduce transmitted vibration and:

- Permit installation *anywhere* in apartment, public, and industrial buildings
- Decrease original building and foundation costs
- Permit installation without reinforcing floors
- Lengthen machine life
- Permit higher operating speeds
- Reduce maintenance costs
- Insure quieter operation

We'll gladly send more information on Korfund Vibration Control for compressors, fans, pumps, boilers, air conditioners and other equipment, write today for your free copy of Bulletin #2, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund office. A half century of experience is at your disposal.

THE KORFUND CO., INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

HARDWARE CO., INC., of Albany, Ga., headed by *B. H. DIXON*.

For *TRANE CO.*— *A. JAMES HACKL* has been appointed manager of the Dallas sales office. Mr. Hackl had been with the Jackson, Miss. sales office for four years prior to his reassignment to the Navy in 1951.

For *BUSH MFG. CO.* — *GEORGE A. HERMAN, JR.* has been appointed to handle sales in the Rochester-Syracuse area.

For *UNISTRUT PRODUCTS CO.* — *GEORGE C. FOY* is manager of the newly activated mid-western district with headquarters at 1013 West Washington Blvd., Chicago.

For *COMBUSTION CONTROL CORP.* — *JOHN M. ENGLISBY* has been appointed eastern regional sales manager. He will be located at the New York area office, 1 Broadway, New York City.

For *A. O. SMITH CORP.* — *LEE W. HANSON* is sales representative of the Liquefied Gas Products Div. of the company. He will cover south and central Texas out of Houston.

For *SERVEL, INC.* — *BERT COLE* has been named vice president and member of the board of *SERVEL-NEW YORK CORP.*, which is the distributing subsidiary in the New York metropolitan area and eastern New York state. Mr. Cole is eastern regional manager for the company.

For *INSUL-MASTIC CORP. of AMERICA* — Two new regional managers. *ABNER H. BAGENSTOSE* is eastern regional manager, covering the states from North Carolina to Maine and westward into Ohio. *JOHN J. MILLER* is in charge of the midwestern area covering the territory from Ohio and Kentucky westward to the Dakotas.

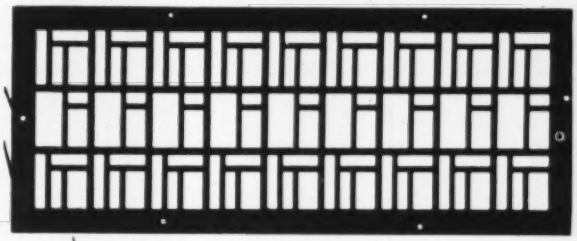
For *SERVEL, INC.* — Three new air conditioning distributors. For north central Ohio, the *CLEVELAND AIR CONDITIONING CORP.* with offices at 2300 Payne Ave.; for the Seattle area, *REFRIGERATION ENGINEERING CO.*, 2120 2nd Ave., to cover surrounding counties; for Oregon, *TEMP-CONTROL CORP.*, located at 2905 N. Mississippi Ave., Portland 12, to cover the state of Oregon and several counties in the state of Washington.

For *SWARTWOUT CO.*, The Roof Ventilation Div.— A new representative is *F. S. CROOK CO.*, 455 Paul Brown Bldg., St. Louis, Mo.

For *ALL-STATE WELDING ALLOYS, INC.* — Eight new welding distributors: *LAKE WELDING SUPPLY CO.*, Muskegon, Mich.; *LINCOLN WELDING SUPPLY CO.*, Lincoln, Nebr.; *SUBURBAN WELDERS SUPPLY*

GRILLES —
FOR THAT

Distinctive Decor



Just as eye-appealing as they are functional, Hendrick Perforated Metal Grilles will greatly enhance the beauty of any decorative motif.

They provide more-than-ample open area for the free passage of air, and are available in a wide variety of designs to best set off your decor. And they're easy to install — always lie flat because of a special flattening operation in their manufacture.

Over one hundred basic designs are available to choose from — many are originals obtainable only from Hendrick. They're furnished in aluminum, bronze, steel or stainless steel. For more complete details on designs and specifications write Hendrick direct!

Hendrick
MANUFACTURING COMPANY

48 DUNDAFF ST., CARBONDALE, PA. • *Sales Offices in Principal Cities*
Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

RADIANT HEATING PIPE
BENT QUICKLY, ACCURATELY
WITH GREENLEE PIPE BENDER

Install radiant heating pipe the timesaving, accurate way . . . with the GREENLEE 770-R Hydraulic Pipe Bender. With it one man *in a few minutes* can make 90° and return bends in *cold* pipe of sizes ½", ¾", 1", 1¼", 1½" and 2". Operation is simple, quick. The GREENLEE is compact, portable . . . easy to carry, set up and operate exactly where and when needed. And it is specially designed to produce *accurate duplicate bends* so that the entire series of bends has smooth uniformity throughout. Do the job easier, faster, *better* with a GREENLEE Bender. Write for free Bender booklet.

TOOLS FOR CRAFTSMEN
GREENLEE

Greenlee timesaving tools for plumbing and heating work . . . Hydraulic Pipe Benders • Tubing Benders • Hydraulic Pipe Pushers • Pipe Bits • Auger Bits • Spiral Screwdrivers • Chisels and many more. Write for details. Greenlee Tool Co., 2349 Twelfth Street, Rockford, Illinois.

CO., INC., Newtonville, Mass.; *McEVOY SUPPLIES INC.*, Charleston, S.C.; *TENNESSEE WELDING SUPPLY CO.*, Knoxville, Tenn.; *CALIFORNIA WELDING CASES*, Salinas, Calif.; *ILLINOIS-MISSOURI WELDING PRODUCTS CO.*, Jacksonville, Ill., and *LEE EQUIPMENT CO.*, Detroit, Mich.

For *QUIJADA TOOL DIV.* of GAINES-COLLINS — *HENRY W. FRITZ* has been appointed midwest sales manager. He will represent the company in Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Michigan, Mississippi, Ohio, Tennessee, and Wisconsin.

For *CURTIS MFG. CO.* — *WALTER SMALLWOOD* is the factory sales representative in Canada, with the exception of British Columbia. Offices are at 187 King St., E., Toronto. Mr. Smallwood will represent all products of the Refrigeration Div.

For *RADIATOR SPECIALTY CO.* — Three new district representatives. *GEORGE E. CLARK* in the Pittsburgh area, *V. T. DUKE* in the Memphis area, and *HARRY R. PUTNAM* in the Chattanooga area.

For *FARR CO.* — Two new sales and service organizations representatives are *FILTER ENGINEERS, INC.*, of Chicago, headed by *R. A. VAN NEST* and *AIR FILTER SALES AND SERVICE OF MIAMI, INC.* headed by *LOUIS NETT* and *EMIL WANATKA*.

For *JACKSON AND CHURCH CO.* — *HAL BALES* has been appointed sales representative in North and South Carolina. Offices are in Charlotte, N.C.

For *U. S. MACHINE DIV., STEWART-WARNER CORP.* — *GERALD F. DEER* has been appointed regional sales supervisor of the western division of the company for Winkler heating equipment.

For *FARR CO.* — Enlarged territory for its New Jersey representative, *A-C PRODUCTS CO.* of Paterson. The new territory now includes the metropolitan New York area and offices are being opened there.

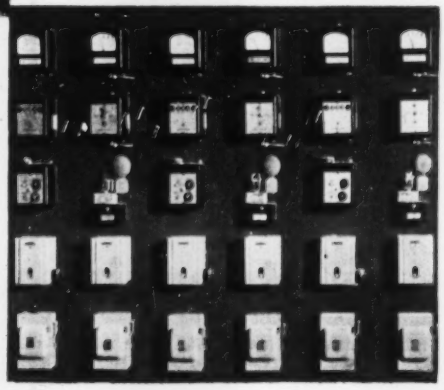
For the *NATIONAL RADIATOR CO.* — *EDWARD EDELBLUT* now is covering the city of Chicago for the firm's heating products. Mr. Edelblut has been chief clerk of the Chicago office since 1925.

For *WESTINGHOUSE ELECTRIC CORP.* — A franchise to sell Westinghouse air conditioning products has been awarded to *VENT-O AIR CONDITIONING CORP.* of Brooklyn. Offices are at 426 Fourth Ave., Brooklyn and 51 Center St., Hempstead, L. I.

For *BUSH MFG. CO.* — *R. G. DINHAM CO.* of Minneapolis is the new sales representative in Minnesota, North and South Dakota and western Wisconsin.

Military base equipped with Perfex instruments

Panelboard below, with three sets of Perfex Instruments, automatically controls three boilers.



Bases throughout the nation are now stretching fuel supplies and helping conserve our natural resources with Perfex Industrial Instruments. O'Hare Field is one of the most recent military installations. Send for latest bulletin on money-saving controls for gas, oil, or stoker-firing.

PERFEX

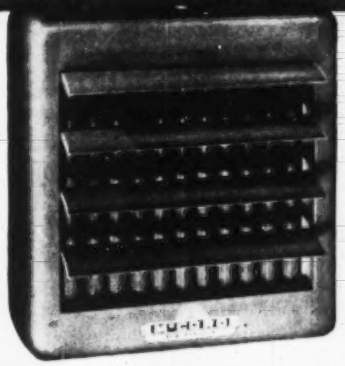
INDUSTRIAL INSTRUMENTS

PERFEX CORPORATION, MILWAUKEE, WISCONSIN • In Canada, Perfex Controls, Ltd., Guelph & Toronto 1

McCORD

HEATING AND AIR CONDITIONING PRODUCTS

HORIZONTAL TYPE UNIT HEATERS



Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

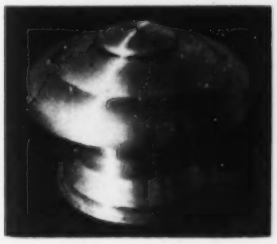
VERTICAL TYPE UNIT HEATERS

A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure. Sizes to 575,000 B.T.U. capacity.

McCORD CORPORATION
DETROIT 11, MICH.

JENN-AIR...
A "WHALE" OF A DISCHARGER!

JENN-AIR POWER ROOF EXHAUSTER

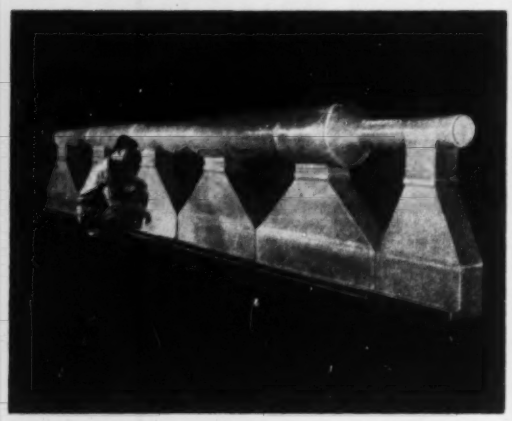


There's only one power roof exhauster in the ventilating field that discharges exhaust air from the **top** third of its unit, YET OFFERS YOU THE ATTRACTIVENESS OF LOW-CONTOUR DESIGN. IT'S JENN-AIR! Completely eliminating the need for high curbs, Jenn-Air Power Roof Exhausters efficiently and quietly ventilate your building without being an eyesore. And remember, you **never** paint a Jenn-Air! Jenn-Air ventilating equipment is constructed entirely of rust-proof (strength without weight) aluminum. For longer-lasting equipment, for trouble-free ventilation . . . get Jenn-Air. Available in roof or wall models.

Send for free illustrated brochure, c/o Dept. C-9.

JENN-AIR PRODUCTS COMPANY
ARCHITECTS & BUILDERS BLDG. • INDIANAPOLIS 4, INDIANA

FOR MAXIMUM PROTECTION
From Corrosive Fumes and Liquids



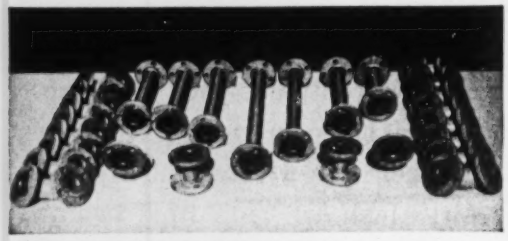
Typical Rigidon Solid Plastic Hood and Duct Sections Ready to Install

SPECIFY *RIGIDON* SOLID PLASTIC EXHAUST HOOD AND DUCT SECTIONS FOR ACID FUME SERVICE

Use Rigidon Solid Plastic Hoods & Ducts

- Excellent Chemical Resistance
- Low Initial Cost
- Light Weight and Maximum Strength
- Wide Variety of Standard Designs

For Your Lined Pipe Requirements



Steel Pipe Lined with Neoprene Rubber for Temperature and Corrosion Resistance.

WRITE TODAY FOR ILLUSTRATED BULLETINS NO. 752, 753, and 754 ON SOLID PLASTIC

You are assured longer service life and less maintenance cost by our expert workmanship and unbiased selection of the best lining materials for your specific requirements.

CHEMICAL PROOF LININGS · TANKS HEATERS PLASTICS

Sales Representatives in All Principal Cities

HEIL PROCESS EQUIPMENT
CORPORATION
11901 Elmwood Avenue • Cleveland 11, Ohio

Other Heil Products Include: Impervious Graphite Heating and Cooling Units • Lined Storage and Process Tanks • Acid-proof Maintenance Materials • Structural Plastics • Steam Jet Agitators • Lead Fabrication

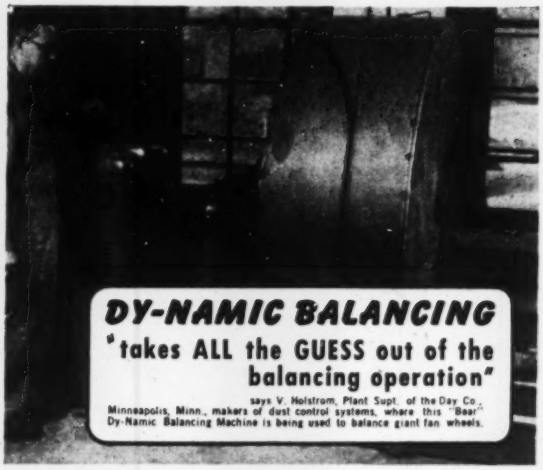
For *HENRY VALVE CO.* — Reassignment of territories following the resignation of Gordon Wheeler as sales representative. *BERTHOLD ROSSNAGEL* will now represent the company in Kentucky, Michigan, Ohio, West Virginia, western Pennsylvania, and Indiana, except Lake county, and Ontario, Can. *J. R. McCAHILL* will represent the company in Illinois, eastern Iowa, and eastern Missouri, Minnesota, Wisconsin, and Manitoba, Can.

For *WOLVERINE TUBE DIV.* of *CALUMET & HECLA, INC.* — *JOHN R. GAVIGAN* is the new sales representative for southern Indiana and Kentucky with temporary offices at 4 S. Main St., Dayton, Ohio. A branch office in Louisville, Ky. will be established in the near future.

For *CORY CORP.* — The new midwest division sales manager is *E. W. GUTGSELL.* He will handle the firm's Chicago, Milwaukee, Minneapolis, Iowa and Detroit areas with headquarters in Chicago.

For the *MARLEY CO.* — *ORVILLE BLOEBAUM* is the new San Francisco district manager succeeding the late A. C. Elias.

For *COMBUSTION CONTROL CORP.*—The new office manager for the Cleveland area is *EARL L. BEDARD.* He will direct activities in Ohio, Kentucky, West Virginia, Western Pennsylvania, southern Indiana, and western Maryland territories with headquarters at 204 Lincoln Building, 616 St. Claire St., Cleveland.


DY-NAMIC BALANCING
"takes ALL the GUESS out of the balancing operation"
says V. Holstrom, Plant Supt. of the Day Co., Minneapolis, Minn., makers of dust control systems, where this "Bear" Dy-Namic Balancing Machine is being used to balance giant fan wheels.

SIMPLIFIED OPERATION of "Bear" Dy-Namic Balancing Machines is so fast, so economical, so easy to learn that manufacturers, maintenance shops and others are employing this revolutionary method with top-production results. No complicated manipulations to learn! Average shop man can learn to balance in a few hours! Get full details by sending for **FREE DY-NAMIC BALANCING MANUAL** ... tells how you can eliminate noise and vibration, reduce wear and improve performance of rotating parts, *quickly, accurately,* and *economically.* Write: Bear Mfg. Co., Dept. H-16, Rock Island, Ill.

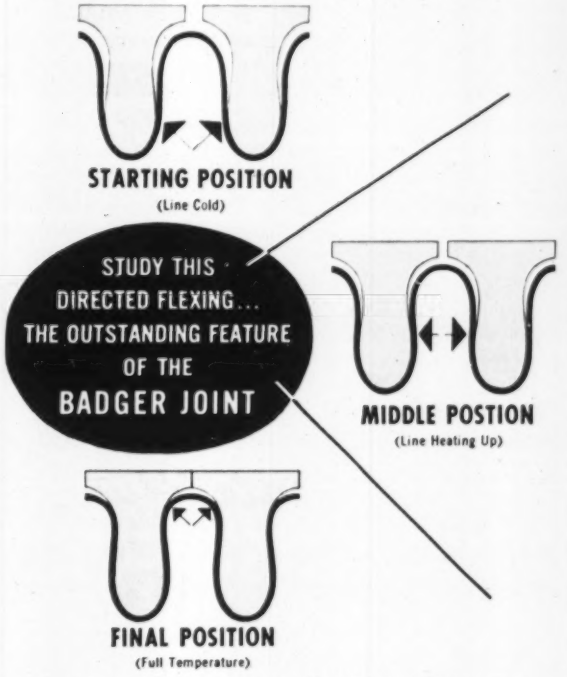
6040

"BEAR"
STATIC AND *DY-NAMIC BALANCING* MACHINES
balance rotating parts weighing from 4 oz. to 8 tons

directed *Flexing*

...distributes flexing stresses
...multiplies expansion joint life

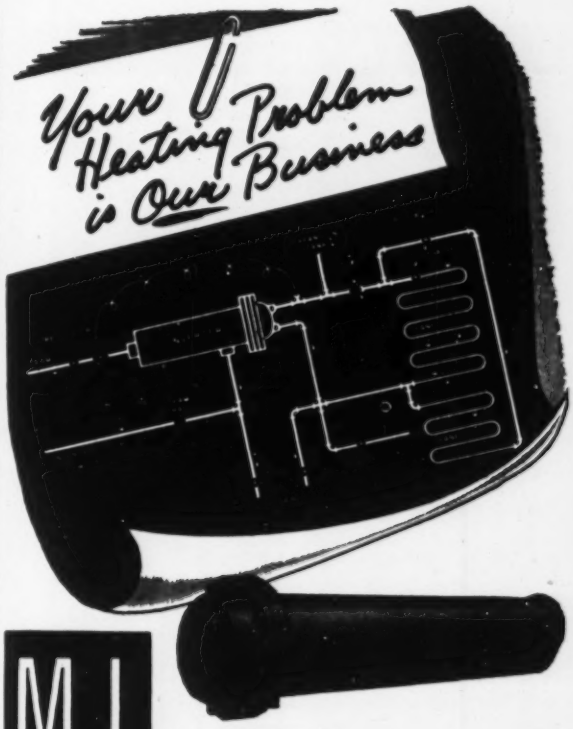
ON THAT pipe line you are installing, you will want to avoid expansion joint maintenance... which means, of course, you will want the packless, corrugated type of expansion joint. And you will want the best functioning, most durable design in the corrugated type of joint.



Note how the corrugation, when hit by the expanding pipeline, wraps itself around the surface of the matching equalizing rings which 'direct' the flexing. Stresses are distributed evenly over all areas of the all-curve corrugations, in contrast with straight-sided corrugations which when flexing move forward and backward as in a plane, concentrating stresses at the top and bottom of each corrugation.

It's this engineering thinking upon which the design of the Badger Expansion Joint is based that is your assurance of buying the best when you buy Badger.

BADGER MANUFACTURING COMPANY
Original and Sole Manufacturer of Badger Expansion Joints
230 BENT STREET • CAMBRIDGE • MASS.



M&L ...Traditionally the right equipment for every Water Heating purpose

When your plans include heating water with live or exhaust steam—when they call for hot water supply to radiant heating panels or other hot water systems—then use M & L equipment.

There are many reasons why M & L equipment is traditionally selected for dependable, uninterrupted service—one of which is the extreme care exercised in assembling, to insure longer service life.

Standardized Flexibility

The unique M & L method of fabrication, which permits custom-built equipment to be made from standardized components at a substantial saving in first cost—fits the equipment to the job to be done.

Send for more details on this worthwhile economy. Please include complete operating conditions in your inquiry to receive an accurate, individual proposal.

Manning & Lewis Engineering Co.
32 Ogden Street · Newark 4, New Jersey
SALES REPRESENTATIVES IN PRINCIPAL CITIES

KEYNOTES
WE SELL KEY GRAPHITE PASTE
"Hey, Joe... LOOK!"
Key-Graphite Paste is used EVERYWHERE for sealing oil and high pressure steam lines.
(Write for free sample... it's "out of this world!")
SEALS TIGHT... BREAKS RIGHT!
A Product of KEY COMPANY
KEY
GRAPHITE PASTE
2617 McCasland • East St. Louis, Illinois

For *MINNEAPOLIS-HONEYWELL REGULATOR CO.* — The new manager of the eastern region is *FRED KAISER*. The eastern region covers New York, New Jersey, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont and Maine with headquarters in New York City. Mr. Kaiser succeeds *ARNOLD MICHELSON* who is now resident vice president of the New York office.

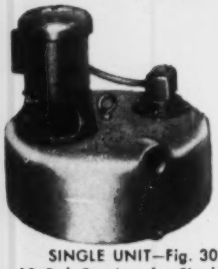
A father and son team, *PHILIP A. GAHM* and *PHILIP A. GAHM, JR.*, have been appointed sales representatives of the *BONNEY FORGE & TOOL WORKS* for the New England territory.

For *SERVEL, INC.* — *EDWARD F. MEER* has been appointed service representative for the commercial electric refrigeration division. In his new position, Mr. Meer will handle contacts with the firm's commercial refrigeration customers. His headquarters are in Cincinnati.

Two new application engineers have been added to the Pittsburgh, Pa., and Newark, N. J., sales offices of the *RELIANCE ELECTRIC & ENGINEERING CO. GARVIN L. JONES* is located at 535 High St., Newark. *THOMAS J. LISY* has headquarters at 1030 Park Bldg., Pittsburgh.

For *MARSH HEATING EQUIPMENT CO.* — A new sales representative in the Baltimore area is the *DEXTER CO.* located at 2021 Maryland Ave., Baltimore 18, Md.

LOW PRESSURE SYSTEM *Condensate Pumps*



SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

weil TVC PUMP

LOW RETURN CONNECTION
LOW SPEED, LONG LIFE
CAST IRON RECEIVER
LOW WATER LINE
ELECTRODE OR FLOAT SWITCH CONTROL

DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7¾₆"

TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

See Bulletin TVC-300-C for Full Specifications

Intermediate Sizes Based Upon Discharge Pressure Required Are Available.

weil PUMP CO. 1514 NORTH FREMONT ST., CHICAGO 22

FLEXIFLO

ADJUSTABLE AIR DIFFUSERS

ADJUSTABLE AIR PATTERN | VOLUME CONTROL | DRAFTLESS DIFFUSION

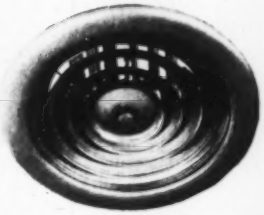
FLEXIFLO
FOR COOLING

Air travels in a constant pattern parallel to the ceiling regardless of any adjustment in air volume.

Type R

FLEXIFLO
FOR COOLING AND HEATING

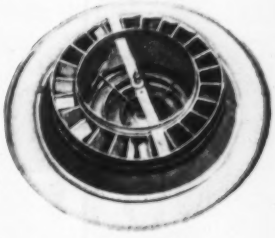
Air diffusion pattern and volume are easily adjustable, after installation, for any conditions, supplying air at any angle.



Type V

FLEXIFLO
SUPPLY AND RETURN

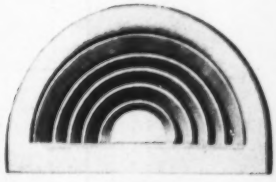
A combination supply and return outlet made with either the Type R or V blades. Fully adjustable.



Type CH

FLEXIFLO
FOR SIDEWALL AND CEILING

Provided with either Type R or V blades to blow air in desired pattern for cooling or heating.



Type S

Get the latest Flexiflo technical data on the complete line of better designed, low cost diffusers that meet any required operating conditions.

FLEXIFLO **Universal Diffuser Corp.**
1360 Garrison Ave. • New York 59, N. Y.

Lo-BLAST Economite Gas Conversion Burner

LO-BLAST

POWER-TYPE GAS CONVERSION BURNER

CAPACITIES 70,000 TO 20,000,000 BTU INPUT

Regardless of the size of the heating plant, Lo-BLAST Gas Burners deliver more heat per fuel dollar. In 19 years of actual operation, these power-type units have consistently cut fuel and service costs.

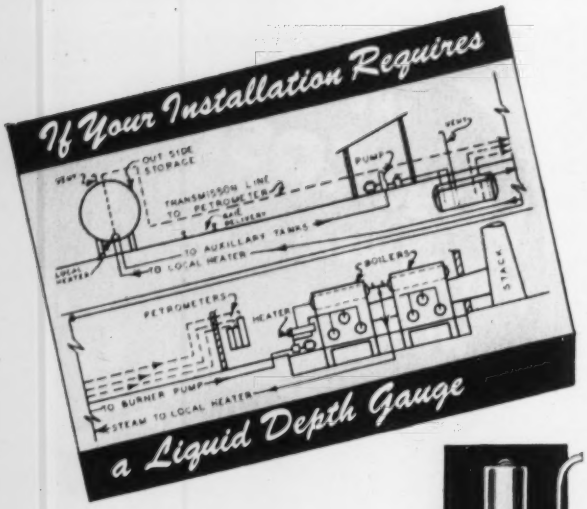
Because primary and secondary air is perfectly controlled from a blower source, the Lo-BLAST Burner is independent of variable natural draft. Hence it is particularly well suited for downdraft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to crown sheet as well as side walls.

Other features include soft, quiet flame . . . standard controls with positive acting pilot and blower safetys . . . sturdy, fool-proof design . . . easy to install because completely assembled and factory-tested on gas . . . competitively priced.

A Lo-BLAST dealership is profitable! Complete range of capacities and a nation-wide reputation for economy make this burner a strong seller. Write for information.

The standard Lo-BLAST Gas Conversion Burner

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.



Specify:

PETROMETER

REMOTE READING

TANK GAUGES

THE BEST GAUGE FOR:

Commercial and Industrial Fuel Oil Tanks

Domestic Installations with Buried Tanks

Storage Tanks for other liquids—gasoline, solvents, acids, etc.

Here's Why:

No troublesome moving parts—operates on the sound principle of the U-tube. Simple, dependable and accurate.

Large, easy-to-read vertical scale gives tank contents at a glance. Eliminates the cumbersome measuring stick and the inconvenience of climbing the tank.

Installation is easy—gauges can be installed on tanks above or below ground level and up to ¼ of a mile away. The tank assembly for the gauge can be installed even when the tank contains liquid. It can also be fitted in the tank separately to complete the tank work. The gauge can be connected any time later. Just tighten one simple connection and the job is finished.

FOR TANKS 20 INCHES TO 50 FEET DEEP. ***Write for Bulletin PH.***

LIQUIDEPTH INDICATORS, INC.

43-22 TENTH ST., LONG ISLAND CITY 1, N. Y.

NEW BOOKS & REPORTS...

Pumps for Liquid Metals

Liquid metal heat transfer systems and liquid metal nuclear power cycles are gaining greater use in industry with the development of liquid metal circulating pumps. The advantages and operation of these pumps are discussed in the article, *Development of Special Pumps for Liquid Metals, Their Power Supply, Valves, Bearings and Instrumentation*, appearing in the May issue of *Mechanical Engineering*. Written by Edward F. Brill, chief engineer, Atomic Power Section, Allis-Chalmers Mfg. Co., the paper was presented at the 1952 annual meeting of the American Society of Mechanical Engineers in New York.

The two main types of pumps discussed are the electromagnetic, which makes use of the principle that a force acts on a current-carrying conductor disposed in a magnetic field at right angles to the conductor, and the mechanically driven pumps of the shaft-seal or hermetically sealed design Also covered are flow-circuit controls, electromagnetic flowmeters, flow measurements using orifice plates, pressure measurements.

Heat Loss Estimates

The four page *Heat Loss Estimate Sheet*, used for preparing analyses of thermal insulation for heated industrial equipment, has recently been revised by the Industrial Mineral Fiber Institute, Inc. The tabular estimate sheet is supplemented by four reference graphs and tables which aid the insulation engineer and specifier in deter-

FOR
SPEED AND ECONOMY
INSULATE
WITH
Miracle
SURFACE ANCHORS AND ADHESIVES
Miracle Surface Anchors bonded with Miracle Adhesives provide firm anchorage for all types of Insulation. This includes Batt, Fiber Glass, Foam Glass, Cork, etc. to ducts, walls, or ceilings. No drilling, welding, bolts, screws or other mechanical means of attachment required. Miracle Surface Anchors are available in a variety of shapes and sizes to accommodate the particular job, and have been endorsed by leading Insulation Contractors and Architects everywhere because of their labor and time saving features. For information write:
Dept. HPAC-9
MIRACLE ADHESIVES CORP.
214 E. 53rd St., New York 22
For anchors write
DEVICES, INC.
214 E. 53rd St., New York 22

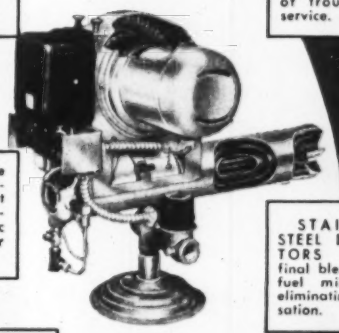
The "Inside Story" of SIEMON Power-Flame SUPERIORITY

Power-Flame units (all models) are shipped completely assembled with controls wired. Just connect power and gas lines.

Quiet, amply-sized blowers provide balanced air mixture for very high heating plant efficiency.

Controls burner mounted and tested. Installation cost reduced to a minimum.

Motors amply-sized and properly applied bring to Siemon users a lifetime of trouble-free service.



Lighting made easy. Push button runner pilot on smaller capacities. Electric ignition on larger models.

STAINLESS STEEL DEFLECTORS provide final blending of fuel mixture — eliminating pulsation.

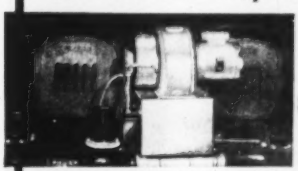
Balanced air adjustment. Precision built to provide metered air for complete combustion.

"Tube within a Tube" design. A Siemon exclusive means quietness and very high efficiency.

The GAS Conversion Burner

Engineered for "Hard to Fire" Applications

Forced-draft design reduces to a minimum the problem of natural drafts. Perfect intermixing of air and gas results in real fuel saving. Highly efficient in down-draft heating plants. Gun-type design permits installation in a minimum of space.



Another example of Power-Flame versatility. This installation made over a coal stoker.

Models in capacities from 85,000 to 3,000,000 B T U input. All units are completely packaged and gun-type design installation costs reduced to a minimum.

You owe it to yourself to get the facts about Siemon's "profit plan." Write today for literature and information about Power-Flame Gas Conversion Burners.

Siemon Power-Flame BURNER

Siemon Manufacturing Co.
1819 Holmes
Kansas City, Missouri

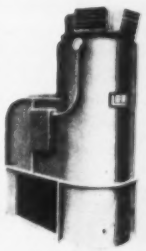
BE SURE

BEFORE YOU BUY

Specify LEE

HEATERS SINCE 1918

Another direct service of Lee . . . A complete engineering survey of your heating & ventilating problems with a recommended solution made by our highly trained and experienced heating and ventilating engineers is at your demand absolutely free. . . No matter how large or small a project.



MODEL UD

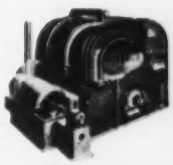
Lee Corporation maintains a skilled staff of engineers to give you complete engineering service in all major branches of engineering—

ELECTRICAL — BOILER ROOM
STRUCTURAL — POWER HOUSE
MECHANICAL — DESIGN
HEATING & VENTILATING

MODEL VTH

A general office staff is also ready to follow your order promptly and efficiently.

MODEL BST



MODEL TSE

LEAN TO LEE . . . SPECIFY LEE

The complete engineered heater

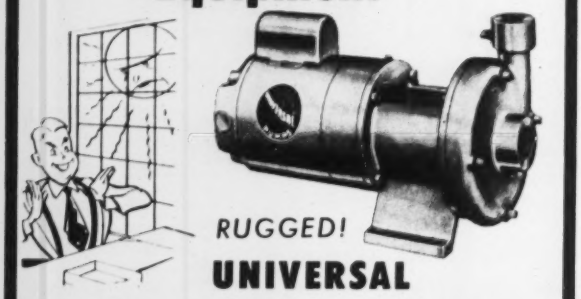
LEE
HEATERS SINCE 1918

LEE CORPORATION

1011 Tatnall Street
Wilmington, Delaware

Baltimore, Md. — New York, N.Y.
Chicago, Ill.

Especially Designed for Air Conditioning Equipment



RUGGED!
UNIVERSAL
Centrifugal **Pumps**

- Series WXH low Priced
- Highest quality construction
- Motor—standard make, 3450 RPM
- Shaft Seal—mechanical cartridge type or stuffing box
- Shaft—Precision ground . . . smooth, quiet operation
- Impeller—all bronze, fully enclosed
- Suction—single stage end suction units

Available from ½ HP through 5 HP . . . designed for efficient, dependable operation . . . ideal for air conditioning, with large capacities at moderate heads. Write for descriptive circular.

HPA-9

UNIVERSAL Mfg. Co.

1440 SAN PABLO AVE. BERKELEY 2, CALIF. • 2114 S. 41st STREET LOUISVILLE 11, KY.

mining heat losses from either flat surfaces or piping and in selecting optimum insulation thickness.

Step-by-step instructions are given for recording survey data for each type of heated surface and for obtaining the required calculated data. The results achieved with the sheet include estimated total heat losses for given thicknesses of mineral wool insulation (as compared to bare-surface losses) and the Btu and dollar savings provided by the insulation. Numerical examples are calculated in detail for three common types of high temperature surfaces—piping, flanges and fittings, and flat areas.

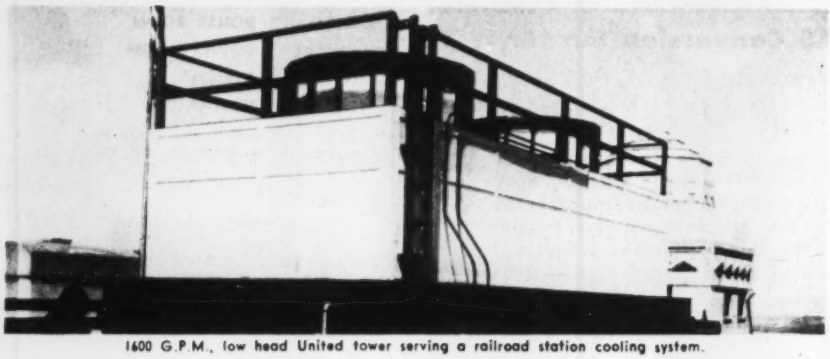
Copies of the estimate sheet may be obtained for 30 cents a dozen from the Executive Director, Industrial Mineral Fiber Institute, Inc., 441 Lexington Ave., New York.

Pumps, Types and Selection

Pumps, Types, Selection, Installation and Maintenance is a complete guide to show what kinds are available, how to select and install them, how to operate and maintain them, how to locate and remedy pump troubles. A wide range of pump applications are discussed, including boiler feed, paper stock, deep well, sewage and sludge, chemical, food products, oil field, gasoline line, fire, corrosive, mine, etc. Performance features and service limitations of the various types of pumps are included.

Written by Frank A. Kristal and F. A. Annett, this new second edition contains many new pump designs and applications developed since the first edition was published 13 years ago. Chapters on pump priming and variable-displacement and proportioning pumps have been re-

Best Protection for a Good A-C Job!



1600 G.P.M., low head United tower serving a railroad station cooling system.

A UNITED COOLING TOWER

It takes a good cooling tower, properly designed, enginered and constructed, to make a good air conditioning job stand up. United builds that kind of tower . . . in capacities for any size installation.

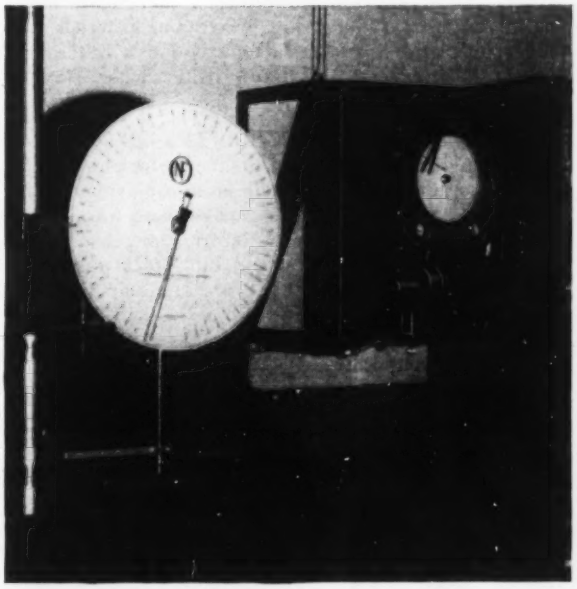
Also redwood filled mechanical draft steel towers, 3 to 15 tons capacity and package type redwood spray towers, 3 to 30 tons.

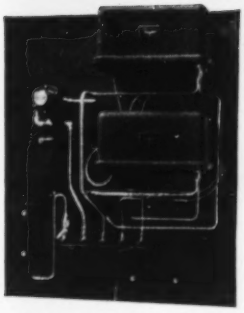
Let United figure with you on your next A-C job.

UNITED COOLING TOWER COMPANY
4022 Broadway, Kansas City 2, Mo. Plant: Pilot Point, Texas
Authorized representatives in Principal Cities

±1% HUMIDITY CONTROL

For Heating, Piping and Air Conditioning





Now your laboratory or test room can have humidity control on the basis of *percentage of relative humidity*—instead of on the individual performance of wet and dry bulbs. Taylor's Wet-and-Dry Bulb Temperature Controller (above) can maintain ± 1% relative humidity. That means you have standard conditions for physical testing of products. This amazingly close humidity control is achieved by the Taylor FULSCOPE* Recording Wet-and-Dry Bulb Controller using as measuring systems two Taylor TRANSAIRE* Temperature Transmitters with SPEED-ACT* compensation for lags in heat transfer (see picture at left).

If your production requires close humidity control, it will pay you to look into Taylor Automatic Control with TRANSAIRE Transmitters. Ask your Taylor Field Engineer or write for **Bulletin 98140.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Trade-Mark

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

EFFICIENCY—DURABILITY STRESSED BY NATIONAL CHAMPION

National Heater Executive Cites Internal Construction as Index to Heater Efficiency

Efficiency and rugged construction are elements demanded by engineers who are responsible to clients for selection of direct-fired space heaters, according to George C. Costello, secretary-treasurer of the National Heater Company, manufacturers of National Champion direct-fired heating equipment with headquarters in St. Paul, Minnesota.

"Internal construction is the major factor in determining heater efficiency," the executive said. "The National Champion heater has, in its design, straight in-line economizer tubes. These tubes allow hot exhaust gases to circulate through many feet of tubing before reaching the exhauster and stack." Economy reached by this system is 80% or more.

Heater Advantages

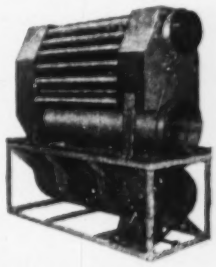
"Advantages of the National Champion heater are inherent in its construction," he continued. "Welded one-piece construction of the firebox and convectors allows for trouble-free long life. The stainless steel, teardrop firebox design is, in itself, an economical feature. Allowing for a clean wipe, the firebox design eliminates refractory maintenance or repair."

National Champion equipment, heavy and light oil series have been listed by Underwriters' Laboratories, Inc. and meets requirements for safety both from the standpoint of electrical safety control sequence and the firebox surface and casing temperatures to qualify on minimum clearance specifications.

Large Area Heating

Designed for large area heating, National Champion units are produced in 12 models with capacities ranging from 200,000 to 2,000,000 BTU per hour.

All National Champion oil burners are pressure type and carry additional U.L. Listing for added protection. Electronic flame failure control is standard equipment. All units are wire and flame tested at the factory before shipment.



Internal Construction

Information and specifications are available upon request from the National Heater Company, 2184 Cleora Avenue, St. Paul 4, Minnesota.

NATIONAL HEATER COMPANY, INC.

2184 Cleora Avenue, Dept. A St. Paul 4, Minnesota

written. Photographs and detailed drawings are used throughout the book.

The 365-page book is available for $6.50 a copy. Publisher is McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36.

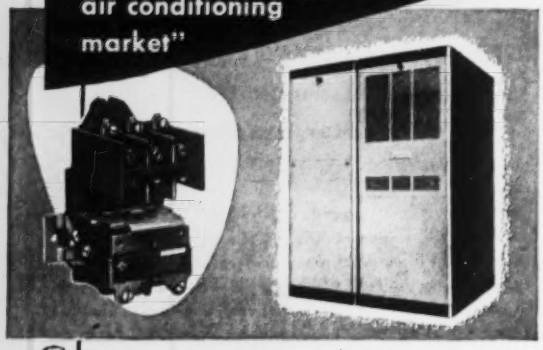
OTHER BOOKS AND REPORTS

WORKING TOGETHER FOR SAFETY—employee rules manual for safe work habits. The practical experiences of workers, supervisors and safety specialists have established the safe practices covered, beginning with a list of general safety regulations and continuing with special sections on machine operation, hand tools, power tools, protective clothing, fire prevention, materials handling and many other related topics. For a free sample copy and prices for quantities, write to the National Safety Council, 425 N. Michigan Ave., Chicago 11.

PHYSIOLOGICAL OBJECTIVES IN HOT WEATHER HOUSING—an introduction to the principles of hot weather housing design. In addition to supplying detailed plans for climatic protection in hot dry and warm humid environments, much technical information is given on basic climatology in tropical and subtropical regions including air temperature, vapor pressure, air movement and radiant energy.

The book was prepared by Dr. Douglas H. K. Lee, professor of physiological climatology, Johns Hopkins University, under a contract with the Dept. of State. It was published by the Housing and Home Finance Agency,

Speaking of FURNAS Contactors, Lennox Furnace says: "Closest...to what we consider ideal for the residential air conditioning market"



KEEPING LENNOX HOME AIR CONDITIONING SYSTEMS working efficiently and quietly is the job of Furnas Electric magnetic contactors.

Frank Osborn, air conditioning engineer at Lennox Furnace Company gives these reasons why he selected Furnas Electric contactors:

QUIET OPERATION...

Mr. Osborn likes Furnas Electric contactors because they are "relatively free of operating hum." He comments: "quietness ... is of utmost importance in residential air conditioning applications."

EFFECTIVE PERFORMANCE...

Since residential air conditioning systems are subject to wide voltage fluctuations, Osborn points out that the Furnas Electric contactor has a big advantage with "its relatively low inrush and holding current characteristics."

LOW ORIGINAL COST...

The price of Furnas Electric contactors is hard to beat! Compared with other types, Mr. Osborn says this: "Furnas contactor is in a price and duty range more compatible with the residential appliance market."

These are important reasons why Furnas Electric contactors are especially suited for use on air conditioning systems. Proved in performance in a *wide range of applications,* Furnas Electric equipment has built a record that speaks with authority.

***NEW* SIZE 2½ MAGNETIC CONTACTOR AND STARTER...**

Now being offered ... another in-between size that saves you money and space. Available in reversing styles. Rated 20 hp at 208-550 v, 30 hp at 440-550 v ac polyphase; 5 hp at 110 v 10 hp at 208-220 v ac single-phase. Ask for bulletin on YG series.

Furnas Electric representatives are located in major cities coast to coast. For information and free bulletin describing the complete line of Furnas motor control equipment, write to Furnas Electric Company, 1041 McKee St., Batavia, Illinois.

FURNAS ELECTRIC

Batavia, Illinois • Near Chicago

FOR SPACE HEATING AT ITS BEST!

CHROMALOX *Electric* UNIT HEATERS

THE HEAVY DUTY BLOWER-TYPE SPACE HEATERS for PORTABLE or PERMANENT COMFORT HEATING

For complete data on Space Heating electrically for your needs.
WRITE FOR CATALOG 50

Now it's easy to heat the smallest office or largest shop to a comfortable level in coldest weather with Chromalox Electric Unit Heaters. Units are available for portable use or permanent mounting to walls and ceiling, and only Chromalox gives you famous Chromalox Heating Elements. Motor driven fans assure positive air circulation which eliminates cold spots. On larger models, ducts can be used to convey heated air to desired areas. Automatic thermal cutouts assure protection against overheating.

IB-18

Industrial Div., EDWIN L. WIEGAND CO., 7610 THOMAS BLVD., PITTSBURGH 8, PA.

CHROMALOX

ELECTRIC HEATING AT ITS BEST!

ACTUAL SIZE
MERCOID SENSATHERM
The low voltage thermostat that operates directly from the TRUE ROOM TEMPERATURE—no internal heaters, —no cycle adjustments—no special settings—simply install it—set it—and forget it • Equipped exclusively with the Mercoid magnet operated mercury switch—the switch that can give a million operations without deterioration • The cover has a lifetime finish.
AVAILABLE FOR
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REFRIGERATION
AIR CONDITIONING
MERCOID SWITCH 9-81
TROUBLE-FREE PERFORMANCE
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THE MERCOID CORPORATION
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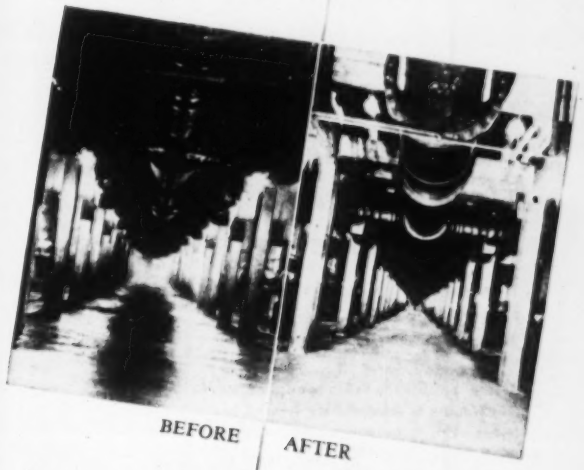
how

pipe galleries stay dry



surrounded by cold water

The pipe galleries in Chicago's water filtration plant are surrounded by Lake Michigan water, as cold as 40° F. Before Kathabar, condensation literally created a fog in the galleries, corroded expensive equipment, rotted wiring, peeled off paint.

Moisture removal by refrigeration was impractical under the conditions prevailing. Kathabar dehumidifying units completely dried up the galleries by lowering the dew point of the air. Eliminating the condensation damage, the Kathabar units pay for themselves in less than 3 years.

This is one of the many contributions of Kathabar humidity engineering. It is used for the packaging, processing, storage, and testing of many products. By preventing frost, condensation, corrosion, and supplying direct dehumidification, Kathabar saves money and improves product quality.

Wherever atmospheric moisture is a problem, Kathabar engineers will be glad to help you find a cost-saving solution.

Write for literature
Group K-53-4.

Kathabar
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORP., TOLEDO 1, OHIO

ALSO MAKERS OF

Surface INDUSTRIAL FURNACES Janitrol AUTOMATIC SPACE HEATING

That's right LOOK AGAIN

here's why the THERMOSTAT in Sterlco TRAPS does more for you...

ALL TRAPS are NOT ALIKE

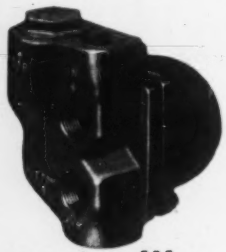
1. It compensates for changes — operates satisfactorily even if pressures vary.

2. It cannot be damaged by excessive steam pressures or by freezing.

3. If the bellows is damaged, the spring action closes the valve. Trouble is immediately located because unit or radiator becomes cold — no waste of steam — no searching. Thermal element easily replaced.

The 3/4" 69B FLOAT and THERMOSTATIC TRAP

Ideal for installation and rehabilitation of unit heaters. Dependable, compact, large capacity, easy servicing and rugged construction makes 69B an outstanding performer on unit heaters and other steam heating equipment.



Install the most convenient Way

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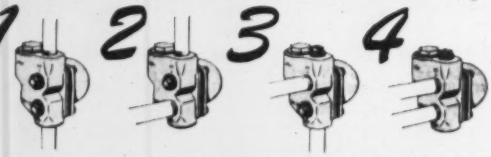
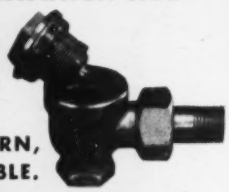


The 1/2" 7–50A ANGLE RADIATOR TRAP

Keep radiators clear of condensate without wasting steam. Sturdy bronze bodies and covers—replaceable seats. Angle, Straightway, Corner or Vertical styles.



STEAM HEATING is MODERN, EFFICIENT and DEPENDABLE.

STERLING, INC.

3732 N. Holton St., Milwaukee 12, Wisconsin

CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

International Housing Activities Staff, Washington 25, D.C.

GAS APPLIANCE SERVICE WATER HEATER MANUAL—condensed and revised fourth edition. The new edition, useful to installation and service men, includes information on controls and suggestions for selecting, installing, adjusting and servicing water heaters. Most service information is placed on diagrams.

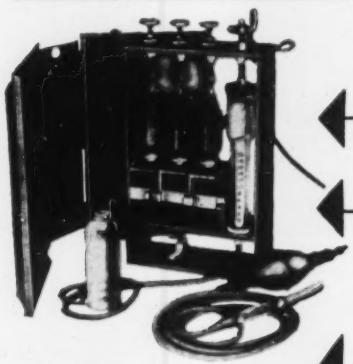
The pocket-size edition contains 248 pages bound with metal rings. Prices are $2.00 for a single copy; $1.75 for 10 to 99 copies, and $1.50 for 100 or more. Requests should be sent to American Gas Assoc., Order Dept., 420 Lexington Ave., New York 17.

SYMPOSIUM ON CONDITIONING AND WEATHERING—series of 10 papers on the effect of atmospheric influences in testing materials such as paper, adhesives, textiles, plastics, cement, electrical insulating materials, etc. Of special interest are, *Air Conditioning in the Manufacture and Testing of Textiles*, by R. H. Brown, executive engineer, Parks-Cramer Co., and *Laboratory Air Conditioning*, by A. E. Stacey, Jr., senior consultant, Carrier Corp.

Copies of the 104-page symposium, in a heavy paper cover, can be obtained from the headquarters of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, at $2.25 each.

Analyze for CO, CO_2, O_2 with one instrument

HAYS ORSAT GAS ANALYZER



Complete—3 absorption units provide complete gas analysis for all the operating engineer's needs.

Rugged—built for continuous field use . . . strong, pressed steel construction.

Portable—contains everything you need to make a complete analysis . . . in one easy-to-carry case. Compact, yet all parts are easily accessible.

send for bulletin 49-668 for complete description of all styles.

The Hays Orsat Type Gas Analyzer is simple, fast, and employs the most reliable method known for obtaining accurate measurement. Available in one, two or three-unit styles (illustrated).

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combustion and industrial instruments and control

ADDED FEATURE in Midget 2 & 3 Way Solenoid Valves

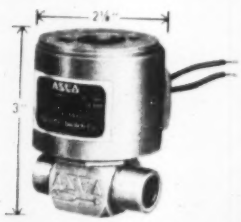
ASCO

Explosion-Proof

protection for

Personnel, Production & Plant

ASCO Midget Valves are now available with explosion-proof housings, designed in accordance with Underwriters' recommendations for use in Class 1, Group D hazardous locations. These Bulletins 8262 & 8314 ASCO Valves with the Explosion-Proof Solenoid Enclosure (they're also water tight) may be just what you need. Classed as "small" valves, they are doing a big job in the automatic and remote control of air, gas, water, light oils, refrigeration and other fluids.



Bulletin 8262 Two-Way ASCO Solenoid Valves (Illustrated) can be obtained with by-pass and metering devices. Valves can be installed in any position. Bulletin 8314 Three-Way Valves can be applied to any 3-way valving requirement regardless of flow directions or pressure application points; no change of springs or other adjustments are necessary. These valves can also be mounted in any position and will give positive tight shut-off.

BULLETIN 8262

2-Way Valve (Normally Closed)**

(Available for all commercial and industrial voltages)

Body Material		Brass or Stainless Steel			
Pipe Sizes (inches)		1/8		1/4	
Orifice Diameters (inches)		1/16	1/8	5/32	3/16
Maximum Pressures lbs./sq. in.	A-C	300*	130	90	60
	D-C	250	70	50	30

*Available 1000 psi in stainless steel; 500 psi in brass.
**Also available normally opened.

BULLETIN 8314

3-Way Valve

(Available for all commercial and industrial voltages)

Body Material		Brass or Stainless Steel	
Pipe Size (inches)		1/8	
Orifice Diameters (inches)		3/64	3/32
Maximum Pressures lbs./sq. in.	A-C	125	45*
	D-C	50	25*

*Pressures slightly lower for liquids.

Since 1888 ASCO Engineers have specialized in the constantly expanding field of Electromagnetic Controls. They have pioneered many new developments and have revolutionized many of the older concepts of automatic controls. Industry looks upon ASCO as one of the leaders in Electromagnetic Controls. Why not let our engineers help you with your problem whether it involves control on a machine of any kind you are designing or control of liquid or gas in your plant?

We also manufacture other types of Electromagnetic Controls including Automatic Transfer Switches, Remote Control Switches, Contactors, Relays and complete Control Panels.

Write for free pamphlet "Small Solenoid Valves."

ASCO Solenoid Valves

Automatic Switch Co.

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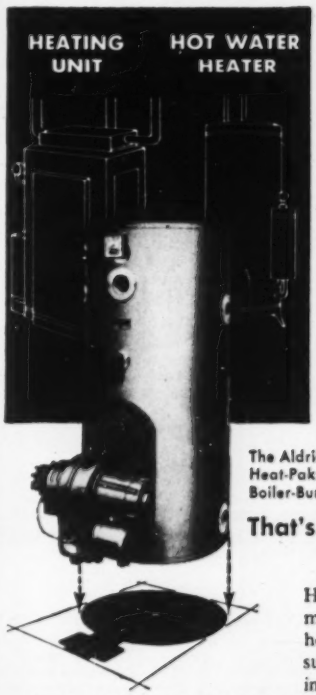
ALDRICH

BOILER-BURNERS



The Aldrich Heat-Pak Boiler-Burner

2 HEATING UNITS *in a* SINGLE SPACE

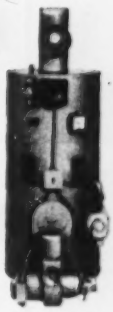
That's the Sales Story to Help You Sell!

Home owners know it makes sense to have BOTH home heat and hot water supply in ONE space-saving unit. Why two separate heating plants and separate fuel supplies? Why not enjoy more usable basement space?

That's the sales story that's making sales for ALDRICH dealers. Tell it and cash in!

YOURS — 90% OF THE HEATING MARKET

ALDRICH BOILER-BURNERS, in a wide range of sizes and capacities, operate on oil or gas, as desired. This gives you access to 90% of the heating market. Also, 60% of home furnaces *cannot provide hot water* supply, as Aldrich units can.



The Thrifty Space-Saving "Gulf Stream" Fully Equipped

THESE ALDRICH FEATURES MEAN BUSINESS!

Heat and hot water can be provided from same unit — same fuel. • Removable hot water coil. Easily serviced and cleaned. • Parts accessible. Handsome hammerloid dress shell. • Removable combustion chamber. • Wide range of sizes ratings.

Write today for the money-making details.

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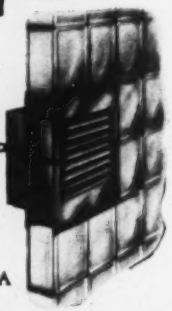
ALDRICH COMPANY

105 East Williams Street, Wyoming, Illinois

A Subsidiary of Breeze Corporations, Inc.

ALDRICH HEAT-PAK PRODUCTS

Perk up- fresh up- with F A I- fresh air inside! Get efficiency with economy by installing MUCKLE FRESH AIR INTAKES — they'll supply fresh, filtered air to each room and condition your plant for *top* efficiency without the expense of costly distribution ducts. Muckle Intakes contain inverted v baffels to arrest direct blow through, oiled spun glass filters and adjustable closing louvers on inside.


A

Model A fits easily into glass block construction by removing 4 blocks. Model B fits any wall thickness. Both models have air opening of 10" x 14" and pass 1000 CFM at .0625" static air pressure.

B

Muckle

WRITE TODAY
For complete information on Muckle Fresh Air Intakes.

MANUFACTURING CO. OWATONNA, 8 MINNESOTA

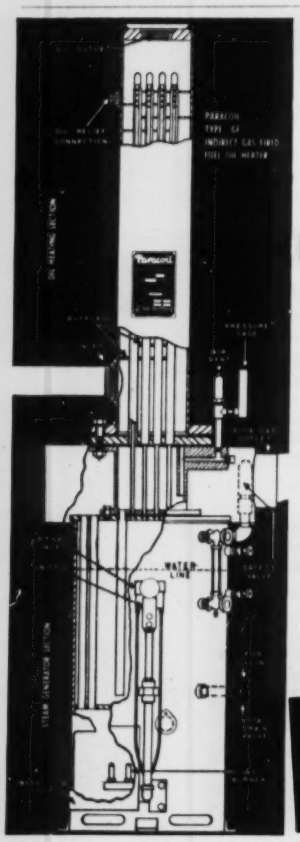
MEETINGS & CONVENTIONS...

SCIENTIFIC CONFERENCE ON SOLAR ENERGY — University of Wisconsin, Madison, September 12-14. The conference, supported jointly by the University and the National Science Foundation, will assess present knowledge of solar energy utilization and point out needed areas for research.

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS — Seventh annual summer meeting, September 18-19, Elkhart Lake, Wis. R. J. Mendenhall, A. O. Smith Corp., Milwaukee, is program chairman.

AMERICAN INSTITUTE OF WHOLESALE PLUMBING & HEATING SUPPLY ASSOCIATIONS, 402 Albee Bldg., 1426 G. St., N.W., Washington, D.C. — Second annual convention, September 20-23, Waldorf-Astoria, New York. Convention chairman is M. W. Dennison of Braman, Dow and Co., Boston.

FIFTH PRECONFERENCE ISA INSTRUMENT MAINTENANCE CLINIC — September 18-20, the three days prior to the opening of the Eighth National Instrument Conference in Chicago. Classrooms will be set up in the Morrison Hotel. The clinic is open to members of ISA, ASME, AIEE, and IRE without charge. A registration fee of $3.00 will be charged to others. Applications should be sent prior to September 14 to the Instru-



WHY BURN EXPENSIVE LIGHT FUEL OILS . . . . . THERE'S A WAY OUT WITH OUR

Paracoil TYPE "GF"

INDIRECT GAS FIRED FUEL OIL HEATER

A RADICALLY NEW APPROACH TO THE PROBLEM OF ADEQUATE OIL PREHEATING UNDER ALL OPERATING CONDITIONS!

The Type "GF" Oil Heater is an integrated self-contained steam vapor generating exchanger using gas as its primary heat source.

However, the gas flame does not come in contact with the tubes containing the fuel oil. Instead, vapor from the lower steam generating section does the actual oil heating!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

A COMPLETE SOLUTION TO THE OIL-IN-BOILER PROBLEM!

As the Type "GF" Heater is in no way connected to the steam or water space of any boiler it may be serving, there can be no possible contamination of the boiler heating surfaces in the event of an oil leak in the heater.

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel • High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated • Reduces oil consumption through improved fuel combustion.

THE PERFECT HEATER FOR:

- Low temperature forced hot water heating systems on No. 6 oil.
- Plants with starting difficulties after week end shutdowns.
- Supplementing inadequacies in present oil preheating systems.

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BULLETIN 60-L
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SERVING THE HEATING INDUSTRY SINCE 1926

Yula

A Complete Line of Dependable Heat Exchangers

Yula-trol Relay box and alarm

Get DOUBLE* PROTECTION for your oil burner installations with . . .

Yula-trol
FUEL OIL DETECTOR
and
Yula "YT" "U" Tube
FUEL OIL HEATER

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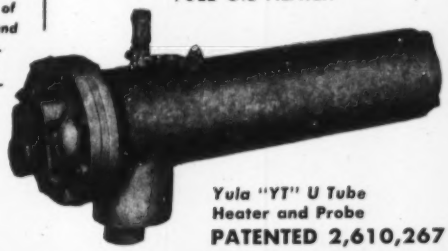
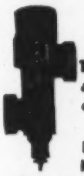


Yula "YT" U Tube Heater and Probe
PATENTED 2,610,267

* **Protects system from serious damage, in case of an oil leak in the Pre-heater, by shutting off oil burner, sounding an alarm, flashing on a red light.**
* **Acts as a Low Water Cut-off**

RESULT: Heating System protection at low cost



OTHER *Yula* PRODUCTS

TYPE "M" MIXING VALVE Automatically mixes hot and cold water or other fluids. Delivers it at any predetermined constant temperature.

INSTANTANEOUS HEATERS . . . Ideal for domestic and industrial applications where large volumes of hot water or other solutions are needed for service water supply or process work

CONVERTERS . . . For water in tubes, steam in shell, or water to water applications. "U" tube bundle construction simplifies cleaning.

DRY EXPANSION FREON COOLERS . . . Designed for air conditioning, refrigeration, and industrial and process uses for cooling water or other liquids.

A.S.M.E. CONSTRUCTION

The Yula Engineering Staff is at your service

YULA WATER HEATERS, INC.
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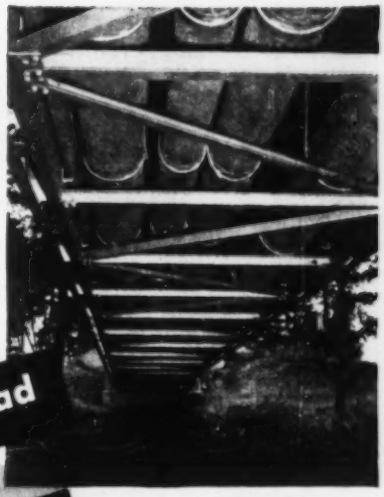
MEMBER FUEL OIL AND WATER HEATER MANUFACTURERS ASSOCIATION

Suspended under a bridge these insulated Ric-wiL lines pipe steam to buildings on a large midwestern college campus.



overhead

underground

Anywhere!

Ric-wiL units can be jacked through tunnels, under streets or railroad tracks without interrupting traffic.

For Fast Economical installation specify Ric-wiL prefabricated INSULATED Piping Systems.

They are fast, easy and economical to install because they are prefabricated under ideal factory conditions. Less work to be done at job site. Complete technical data and detailed working drawings are provided by Ric-wiL engineering service — more savings in installation time and costs.

Whether your job is underground or overhead — if it calls for proven protection and insulation of steam, hot water, oil or process liquid piping — it will pay you to call in the Ric-wiL representative in your district as early as possible in your planning.

Ric-wiL PREFABRICATED INSULATED PIPING — PIPE CONDUIT SYSTEMS

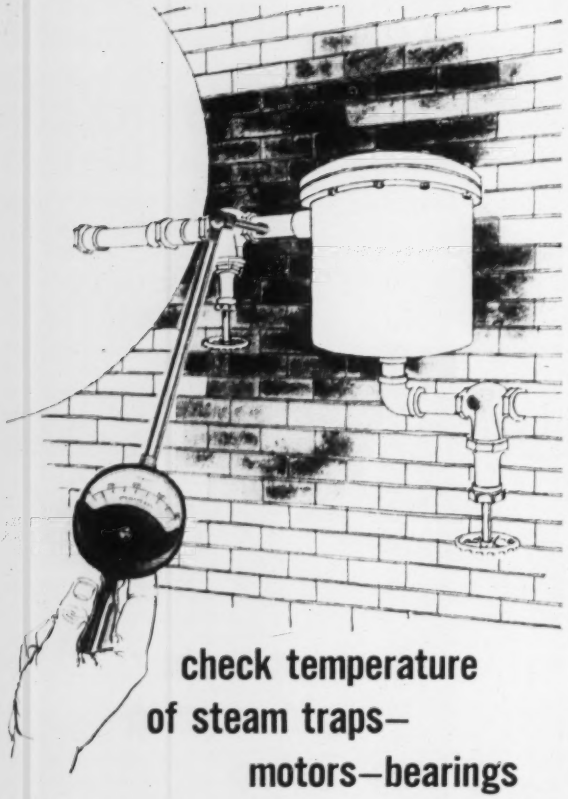
THE RIC-WIL COMPANY • BARBERTON, OHIO

ment Society of America, 1319 Allegheny Ave., Pittsburgh 33, Pa.

INSTRUMENT SOCIETY OF AMERICA, 921 Ridge Ave., Pittsburgh 12 — Eighth National Instrument Exhibit, September 21-25, Sherman Hotel, Chicago. Cooperating groups presenting technical sessions are: American Institute of Electrical Engineers, Instruments and Measuring Committee; the Amercian Institute of Physics; the American Society of Mechanical Engineers, Industrial Instruments and Regulators Div.; the Institute of Radio Engineers, Professional Group on Instrumentation; and the Scientific Apparatus Makers' Association.

CORROSION CONFERENCES — Sponsored by the National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2. The following meetings and conferences are scheduled: Corrosion Short Course, A & M College of Texas, College Station, September 22-25; meeting of South Central Region, October 7-9, Mayo Hotel, Tulsa, Okla.; Short Course on Cathodic Protection, University of Illinois, Urbana, October 12-16; Southeast Region Meeting, Birmingham, Ala., November 12; Western Region meeting, November 19-20, Biltmore Hotel, Los Angeles.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, Fort Wayne, Ind., section—Conference on the application of motors to the air moving industry, and



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 813, 420 N. LaSalle St., Chicago 10, Ill.

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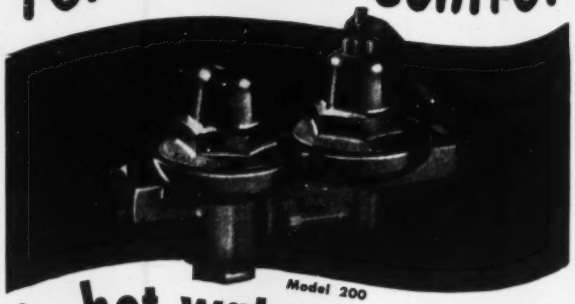
For Pressure Control



in hot water systems. . .

it's Sall BROTHERS

A dependable filler and relief valve for controlling pressures in hot water heating systems. All bronze construction. Factory settings 12 lbs. delivery and 30 lbs. relief.

SALL Fittings greatly improve efficiency of entire hot water system. Only one fitting on return line is needed. This directs free flow of water through radiator.

Sall BROTHERS COMPANY

2324 Kishwaukee • Rockford, Illinois

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TO THE RIGHT PEOPLE
Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.
A.B.C. Reports
ABC

Oh! WHERE *... is my wandering ad tonight?*

THERE are two ways to buy advertising space. One is the guesswork-opinion method. The caption above is the mournful song of an advertiser who is still selecting media the way it was done before World War I, when there were no standards for the circulations of published media and when there was no accepted and approved method of auditing circulations. In those days, advertisers O.K.'d their proofs and sent out their advertising with a prayer that some of their sales messages would find their way to market.

The other way to buy space is the factual, know-what-you-get-for-your-money method. Today advertisers can start their investments on a basis of facts by selecting media with the help of the information in the reports issued by the AUDIT BUREAU OF CIRCULATIONS. This cooperative and nonprofit association of 3300 advertisers, advertising agencies and publishers, organized in 1914, has established standards that make it possible to evaluate the circulations of published media. The A.B.C. maintains a large staff of experienced and specially trained circulation auditors who make annual audits of the circulations of publisher members. A.B.C. reports give the facts thus obtained.

Here are some of the audited facts about business papers that A.B.C. reports tell the advertiser:

—how much paid circulation;
—how much unpaid;
—an occupational or business breakdown of subscribers;
—where they are located;
—how much subscribers pay;
—whether or not premiums are used;
—how many subscribers are in arrears;
—what percentage of subscriptions are renewed.

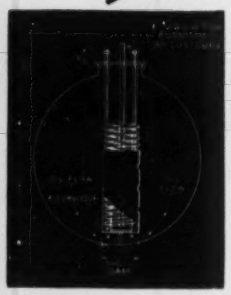
Those who buy advertising on the basis of this factual information, as given in A.B.C. reports, do not have to speculate about the distribution of their sales messages. They KNOW where and to whom their advertising goes. That is why this business paper is a member of the AUDIT BUREAU OF CIRCULATIONS. Ask for a copy of our A.B.C. report and then study it.

Heating, Piping & Air Conditioning

A.B.C. REPORTS—FACTS AS THE BASIC MEASURE OF ADVERTISING VALUE

Solve STORAGE TANK OIL PREHEATING

REMPE
"Hot Spot"
PREHEATER



All-steel shell and coil assembly for preheating No. 5 and Bunker "C" oils and other liquids to proper flow temperature before they enter the suction pipe. Positive preheating by flow accumulator.

Suction pipe, inlet and outlet pipes for heating by steam or hot water go through manhole cover. Made with 14" or 16" dia. shell.

WRITE FOR DETAILS.

Complete facilities for fabrication of pipe coils — all types — all materials. Engineering service. Send details for price.

WASTE TRANSFER EQUIPMENT REMPE CO. Founded 1890

REMPE COMPANY

342 N. Sacramento Blvd., Chicago 12, Ill.

PERFORMANCE MEANS PROFITS!

A assured performance

B bearings—guaranteed

C cost—low

D delivery—immediate

Certified Capacity Ratings of WESTERN ROTARY VENTILATORS sell your customers. See Sweet's Catalog.

Remember — you can't look at a ventilator and judge its value. Western Rotary Ventilators have been thoroughly tested and results published. Check Sweet's, A.E.C. or write for catalog. Features lifetime guaranteed bearings — enduring metallic finish on durable galvanized steel. Throat sizes 6" thru 48". Order from your local dealer. The complete line of Western ventilating equipment is handled by wholesalers coast to coast.

"always on the job—never on the payroll"

WESTERN ENGINEERING & MFG. CO.

4118 OCEAN PARK AVENUE, VENICE, CALIFORNIA

symposium on induction motors, October 6-8, Hotel Van Orman.

Subjects and speakers are as follows:

Fan Motor Characteristics and Standards, T. E. M. Carville, manager, Industrial Eng. Dept., Westinghouse Electric Corp.; *Automatic Temperature Control of Heating, Ventilating and Air Conditioning Air Handling Systems*, G. V. Steffens, district manager, Minneapolis-Honeywell Regulator Co.; *The Application of Shaded Pole Motors to Room Air Conditioners*, R. W. Morgan, chief engineer, Fedders-Quigan Corp.; *Desert Coolers and the Motors Used Thereon*, R. J. Peterson, chief engineer, Utility Appliance; *Ventilation for Farm Buildings*, A. E. Waterman, vice president engineering, James Mfg. Co.; *Armed Services Fan Applications*, C. W. McDowell, manager special products, American Blower Corp.; *Requirements of Air Conditioning Fan Motors*, M. D. Irwin, product engineer, Carrier Corp.; *Underwriters Requirements for Fans*, W. H. Farrell, engineer, Underwriters Laboratories; *Room Air Conditioners*, W. P. King, engineer, Servel, Inc.; *Selection and Application of Industrial Fans*, H. D. Diffenbaugh, engineer, American Blower Corp.; *Attic Fans and Window Ventilators*, W. H. Wentling, assistant chief engineer, The Lau Blower Corp.; *Furnace Fans*, W. A. Rockafield, engineer, The Brundage Co.; *Automatic Protection of Motors in Air Moving Equipment*, W. L. Hirshberg, engineer, Spencer Thermostat Div., Metals and Controls Corp.; *Unit Heater Fans*, A Currie, chief research engineer, L. J. Wing Mfg. Co.; *The Magnetic Noise of Polyphase Induction Motors*, P. L. Alger, General Electric Co.; *Accuracy and Simplicity in Induction Motor Calculations*, Prof. J. F. H. Douglas, Marquette University; *A Slot Combination Chart*

G&O COILS for HEATING and COOLING

G&O RADIATION

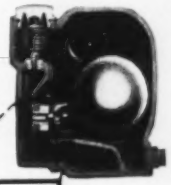
A full line of sizes now available to meet all industrial requirements. Send for catalog.

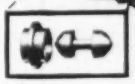
THE G-O MANUFACTURING COMPANY
New Haven 8, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

ADSCO

WHEN the valve and valve seat of an ADSCO Dual Steam Trap become worn, neither these parts nor the trap itself need to be replaced. Merely reverse the valve and seat by a simple operation and you double the life of the trap...

DUAL TRAPS LEAD A DOUBLE LIFE





F & T Type

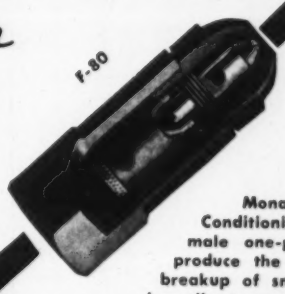
...And here's another great feature of ADSCO Traps. All working parts are mounted on the cover. Pipe connections do not have to be broken for inspection or service...ADSCO Dual Steam Traps are extremely compact with large capacity. Dual inlet and outlet connections reduce installation costs. In the type shown here, an internal thermostatic element provides an automatic air bypass...For complete information, call an ADSCO representative or write the factory.

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

Monarch NOZZLES for HUMIDIFYING



Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG 6-A

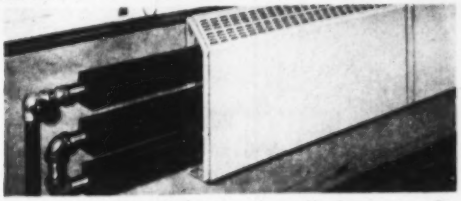
MONARCH MANUFACTURING WORKS, INC.

2523 E. ONTARIO ST. PHILA. 34, PENNA

CANADIAN SALES AGENT (EXCEPT B.C.) CANADIAN GENERAL FILTERS LTD., 2679 DANFORTH AVE., TORONTO 13.

CUSTOM-FIT* ENCLOSURES with AIRFOIL* Finned Radiation

for



- Modern, streamlined heating installations to fit any architectural need.
- Low cost radiation units which are simple to install and have a custom-made look.

WRITE FOR DETAILS

Made by the producers of famous . . .

radiant-ray BRAND BASEBOARD HEATING

*TRADE NAMES OF . .

RADIANT-RAY RADIATION, INC.

900 W. MAIN STREET NEW BRITAIN, CONN.

Send for Nicholson

TRAP CATALOG 751

A Standard Reference on Traps for All Applications

Newly revised, this 32-page reference describes traps for all mediums and pressures: thermostatic and metal expansion for pressures to 250 lbs.; weight and piston-operated for heavy duty. Complete with installation

diagrams and formulae for determining proper size trap.

W. H. NICHOLSON & CO.

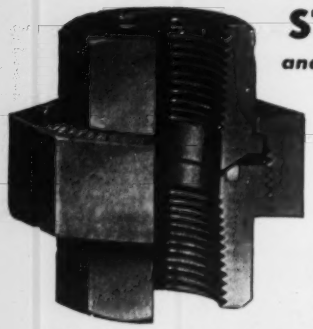
TRAPS · VALVES · FLOATS

198 OREGON ST., WILKES-BARRE, PA.

Jefferson ... the UNION

in which there is

STRENGTH ... and LONG-LIVED SERVICE



Every part of Jefferson Unions is designed for *STRENGTH*, carefree service and leak-proofness without undue wrench pressure. They cost less per year of service. Completeness of the Jefferson line assures simpler piping systems.

Jefferson Unions are of 55,000 p.s.i. tensile strength; malleable iron; seat rings of seamless drawn brass tubing, press-fitted into *machined* channels; seats of true spherical contour.

The Jefferson line includes WOG 2000# to 2" and 1000# up to 4"; straight through unions; union ells and union tees; flange unions; AAR male and female unions; Enduro 300#, Excel 255# and Master 150# unions. All types also available with all-iron seats. Underwriters approved.

Contact your nearest distributor or us direct for your requirements.

JEFFERSON UNION CO.

607 W. 26TH ST., NEW YORK 1, N.Y.

65 Gooding St., Lockport, N.Y. — 35 Fletcher Ave., Lexington 73, Mass.

SPRAY NOZZLES

... FOR LOWER COST

Spray Nozzles alone can often materially reduce spraying costs. Spraying Systems Co. has proved this again and again. Write for Catalogs 22 and 23 . . . and see for yourself.

CLIP AND MAIL

SPRAYING SYSTEMS CO.

3219 Randolph Street • Bellwood, Illinois

☐ Send me Catalog No. 22 ☐ Send me Catalog No. 23

Name

Company Name

Address

City State

for Induction Motors, Prof. J. E. Williams, University of Illinois; *Determination of Core Loss in Polyphase Induction Motors*, F. A. List, Westinghouse Electric Corp.; *The Effect of "D" and "L" Upon Induction Motor Design*, R. F. Woll, Westinghouse Electric Corp.; *Volume Co-Efficient for the NEMA Re-Rated Motors*, J. M. Chirdwin, Imperial Electric; *Induction Motor Letter Symbols for Use in Technical Papers*, S. F. Henderson, Westinghouse Electric Corp.

INTERNATIONAL CHURCHMANS EXPOSITION, 19 S. LaSalle St., Chicago 3 — Second annual exposition, October 6-9, Chicago Coliseum. Hall of Church Designs and International Church Buildings Forum will be featured.

PLUMBING AND HEATING INDUSTRIES BUREAU, 35 E. Wacker Dr., Chicago 1 — Annual meeting, October 8, Palmer House, Chicago. Earl E. Brown is president.

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS — Ninth annual meeting, October 8-9, Sheraton Hotel, Chicago. Sponsored by the Illinois Institute of Technology, Chicago 16, the conference director is Otmar E. Teichmann.

The general session will be led off by W. P. Green, Armour Research Foundation, who will present a paper on "Friction and Wear Phenomena." During the presses session there will be a paper by A. J. DeMattco, Watson-Stillman Co., "Self Contained Pump Units as Applied to Extrusion Presses."

get rid of the "cold room" problem!

WITH THE Gorton SYSTEM of Vaporizing and Equalizing Valves

THE GORTON SYSTEM . . . gives automatic even distribution of heat to every room in the building . . . No cold rooms . . . Stops fuel waste.

EASY TO INSTALL . . . Any steam heating system can be easily changed to a GORTON VAPOR EQUALIZING SYSTEM . . . No piping changes necessary.

PROFITABLE TO HANDLE . . . A sure winner of satisfied customers!

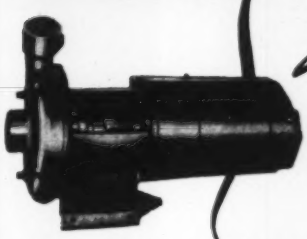
Get the facts . . . Write for Bulletin 118 today!

GORTON HEATING CORPORATION

Since 1887 — Manufacturers of Heating Equipment

CRANFORD • NEW JERSEY

For AIR CONDITIONING and Hot Water Circulating



Jacuzzi

GENERAL PURPOSE
CENTRIFUGAL PUMPS

Low cost utility pumps built for air-conditioning systems, food processing plants, circulating water for cooling towers, for sprinkling lawns, for swimming pools and hot water circulating. Choose capacity and horsepower (¼ thru 5) suited to your needs. Write for Bulletin JGP-2.

Since 1915—the industry's most complete line of pumps and water systems ...originator of jet pumps.

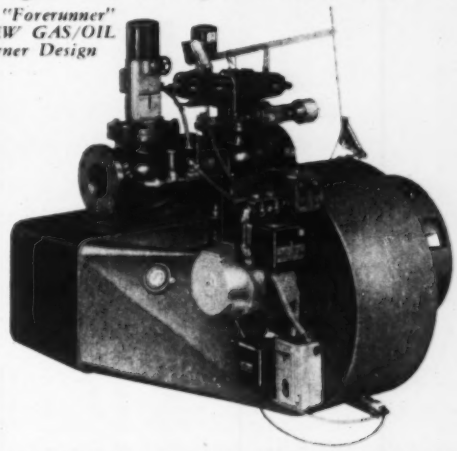
ALSO: ST. LOUIS 23, MISSOURI
BINGHAMTON, NEW YORK
PORTLAND 14, OREGON
MONTERREY, MEXICO

JACUZZI BROS. INC.
RICHMOND, CALIFORNIA

A Distinguished Dual Fuel Burner

Built On
The *Entrained Combustion* Principle

The "Forerunner" of NEW GAS/OIL Burner Design



MEET the LATEST by METTLER. No. 42F-3 (300 HP) Fan-Air Gas & Oil Burner; Simplicity, compactness and modern assembly all symbolic of METTLER Engineering. Not a combination of "Old Stuff" but a NEW precision made product. Write for details Now—Dual Fuel Burners sized from 25 to 500 h.p.

The METTLER CO. Inc.
4366 WORTH ST. LOS ANGELES 63, CALIF.

MASSACHUSETTS Power Fixed and Squirrel Cage FANS

POWER FIXED FANS

Backward curve blade type with non-overloading characteristics. Housings constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

SQUIRREL CAGE FANS

Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia.

Housing shown above for 86½" wheel

Write for catalogs.

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE CLEVELAND 14, OHIO

REDUCING VALVES

No. 700 illustrated — Water pressure reducing 300 lb. initial to 50 lbs. delivery. Spring-diaphragm type for noiseless, dead end service. Large flow passages. Tight closing. Designed for maintenance without removal from line. Compact. Dependable. Other types available. GET BULLETIN 148.

Call Your Supply House or See Classified Phone Directories for Nearest KLIPFEL Agent.

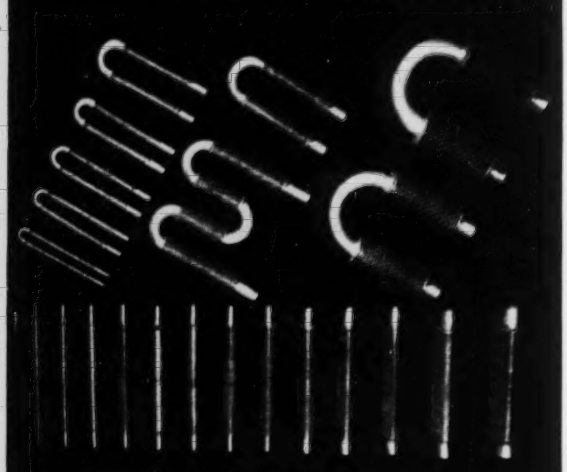
Alabama Birmingham	Illinois Chicago	Missouri St. Louis	Ohio Cincinnati	Tennessee Memphis
Arizona Phoenix	Indiana Evansville	Kansas City Montana	Cleveland Oklahoma	Nashville Knoxville
California San Francisco	Indianapolis Louisiana	Billings New York	Tulsa Oregon	Utah Salt Lake City
Los Angeles Colorado	New Orleans Massachusetts	Buffalo New York	Portland Pennsylvania	Washington Spokane
Denver Florida	Boston Michigan	Syracuse New Mexico	Pittsburgh Philadelphia	Seattle Wisconsin
Tampa Georgia	Detroit Minnesota	Albuquerque North Carolina	Texas Dallas	Milwaukee Canada
Atlanta	Minneapolis	Greensboro		Montreal

K-941

Klipfel VALVES, INC.
HAMILTON, OHIO

RO-FIN TUBES

IDEAL SURFACE FOR HEAT TRANSFER



Over 100 sizes in production!

ROME

TURNEY RADIATOR COMPANY

209 CANAL STREET • ROME • NEW YORK

"Boiler Feed Pumps," by O. M. Kristy, Allis-Chalmers Mfg. Co., and "Ball Piston Pumps and Motors," by H. Stern and W. T. Rauch, General Electric Co., will comprise the pumps session.

"Industrial Application of Non-Flammable Hydraulic Fluids," by D. Milne, General Motors Corp., and "The Effect of Synthetic Fluids on Hydraulic Components and Circuits," by James Robinson, Vickers, Inc. will be the two papers read during the non-flammable fluids session.

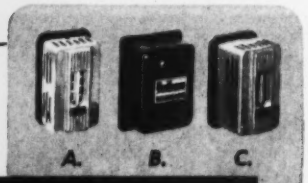
The instrumentation session will consist of papers on, "Pressure Transducers," by R. E. Boyar, Askania Regulator Co., and "A Flowmeter for Measuring Mass Flow-Rate with High Speed of Response," by Dr. Yao Tzu Li of the Massachusetts Institute of Technology.

FIFTH INTERNATIONAL MECHANICAL ENGINEERING CONGRESS, 10 Avenue Hoche, Paris, France — To be held in Turin, Italy, October 9-15. This meeting is the fifth of a series organized by the engineering trade associations of Western Europe. Theme of this year's Congress is, "Production and Assembly Methods for Components in Mechanical Engineering."

NATIONAL ASSOCIATION OF VERTICAL TURBINE PUMP MANUFACTURERS, 301 W. Avenue 26, Los Angeles 31 — Fall meeting, October 11-12, Broadmoor Hotel, Colorado Springs, Colo.

CONFERENCES ON RADIANT HEATING, sponsored by the Dept. of Architecture, Pratt Institute, 215 Ryerson

A. TYPE B2
B. TYPE B4
C. TYPE B3A



SENSITIVE ROOM TYPE THERMOSTATS FOR DOMESTIC OR INDUSTRIAL USE

The three wall mounting thermostats illustrated, provide precise, sensitive control for domestic or industrial heating, air conditioning or cooling systems. Enclosed in smartly styled housings, they will fit into the decorative schemes of homes, offices or industrial plants. Two of the controls, the Type B2 and Type B3A are available in skeleton form for applications which do not require an enclosure. The specifications for the Type B2, B3A and B4 are covered by Bulletin #1-1. Send for it today.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street, Watertown, Mass.

STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

✓ Check your needs . . .

- ☐ Personnel
- ☐ Equipment Sales
- ☐ Equipment Needs
- ☐ Manufacturers Agents
- ☐ Lines, etc.

Whatever your needs in any of the above classifications . . . you can solve them quickly with a classified advertisement. The space rates are reasonable and results are quick. Closing date— the tenth of the month preceding issue.

GET PRECISION TUBE ROLLING IN HALF THE TIME!

Here's a new approach to the problem of tube rolling. The automatic VERNON-ORMECO Tube Expanding Machine utilizes a new controlled method of expanding tubes to produce uniformly tight tube joints. All joints are rolled to the same preselected tightness-fit regardless of variations in tubing or I. D. of tube hole. This greatly reduces the danger of leakage and speeds maintenance and manufacturing jobs.

The VERNON-ORMECO Tube Expanding Machine provides an exceptionally rapid operating cycle and is extremely simple to operate.

Features

- ROLLS UP TO 700 TUBE JOINTS PER HOUR.
- ROLLS ALL TUBES UNIFORMLY TIGHT TO PRE-SELECTED TIGHTNESS-FIT.
- OPERATES IN RAPID AUTOMATIC CYCLE.
- REDUCES DOWN-TIME AND INCREASES TOOL LIFE.

VERNON-ORMECO Write for FREE Bulletin TX-50

TUBE EXPANDING MACHINE

VERNON TOOL CO., LTD.

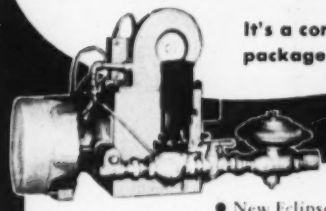
1109 Meridian Ave. Alhambra, Calif. P. O. Box 7555 Houston 7, Texas

Vernon PIPE CUTTING PANTOGRAPH
Vernon "Universal" FLAME CUTTER
Brown STEEL VALVES
Vernon-Ormeco TUBE EXPANDING MACHINE

With this great new Eclipse Combination Gas and Oil Burner

CHANGE FUELS WITH THE FLICK OF A SWITCH

It's a complete package



● New Eclipse Fan-Type Combination Gas-Oil Burner gives you peak efficiency with mixed, natural or LP gas (800 Btu to 5200 Btu) . . . #1, 2, or 5 fuel oil. Snap switch changes burner instantly to fuel selected . . . automatically sets all necessary controls in operation. "Clean-fire" starting delays fuel until blower delivers correct air for perfect combustion. Direct, electric spark ignition for oil—pilot ignition for gas. Safe, positive starting. Electronic control provides 100% efficient flame-failure protection. New built-in tuyere completes exclusive "rotary flame" action of burner. It's a complete burner installation. There's nothing else to buy or install. High quality construction assures years of heating service. Capacities from 400,000 to 2,250,000 Btu. Representatives in all principal cities.

Write for **Eclipse** Bulletin R-100

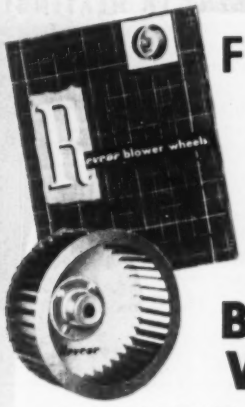
ECLIPSE FUEL ENGINEERING CO., 1139 BUCHANAN ST., ROCKFORD, ILL.
ECLIPSE FUEL ENGINEERING CO. OF CANADA, LTD., TORONTO, ONTARIO

World's most popular mechanical draft COOLING TOWER...

the Marley AQUATOWER

The simple, fool-proof mechanical draft tower for any job requiring 2 to 60 tons of refrigeration. Stocked in a wide range of sizes and models in 30 cities for immediate delivery. Can be located indoors or out to fit the requirements of any commercial or residential cooling job. See your Marley Representative, or write for Bulletin AQ-53

MARLEY ***The Marley Company***
Kansas City, Missouri



FREE . . .

BRAND NEW ILLUSTRATED CATALOG

Describing in Detail

Revcor BLOWER WHEELS

REVCOR BLOWER WHEELS ARE NOTED FOR:

- Providing MAXIMUM AIR and PRESSURE for the particular space dimensions required.
- Superior STRENGTH and RIGIDITY.

Single or Double Inlet Type. Available in Steel, Aluminum, or Stainless Steel . . . in diameters from 1½" to 12". *Also made to your own specifications.*

REVCOR—LOCATED IN LARGER, MODERN QUARTERS ASSURING YOU OF THE FASTEST POSSIBLE SERVICE ON YOUR ORDERS!

Write for Your FREE COPY of the new REVCOR BLOWER WHEEL SPECIFICATIONS CATALOG.

Revcor Dept. A CARPENTERSVILLE, ILL.

DELAVAN SPRAY NOZZLES FOR UNUSUAL APPLICATIONS

Type WD

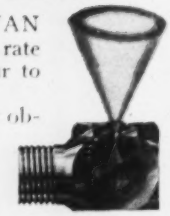
There is a DELAVAN NOZZLE for any flow rate from 2 quarts per hour to 63 gallons per minute.

Type WD — ideal for obtaining finest possible pressure atomization.

Type WS — available for either full or hollow cone spray. Excellent for a wide variety of special applications.

Type WR — a right angle nozzle producing hollow cone spray similar to Type WS.

Type AG — delivers flat uniform spray without concentration at edges. Drifting reduced to minimum.



Type WR

Type WS

Type AG

Write for Catalog No. 31

DELAVAN MANUFACTURING CO.

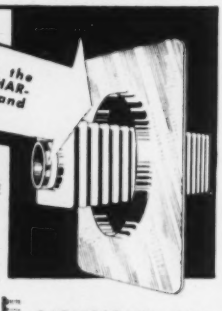
GRAND AVENUE & 4TH STREET

WEST DES MOINES, IOWA

A NEW DEVELOPMENT IN HEATING!

Radiators with extruded collared fins bonded to seamless steel pipe . . . for
Factories
Commercial Buildings
Institutions
Offices
Warehouses
Garages
Hot Houses
Dry Rooms
Homes
(Baseboard)

THE FIN with the COLLAR THAT HARNESSES HEAT and puts it to work!



★ EASY TO INSTALL
★ ATTRACTIVE APPEARANCE
★ HIGHLY EFFICIENT
★ COMPACT

WRITE FOR FREE Bulletin HV-12
Mfrs. Agents and Distributors Wanted.

LEE VINE FIN-TUBE RADIATOR CO., INC.
4 Fair St. New Haven, Conn. U. S. A.

DIAMOND TRADE MARK GRILLES

Look Better — Last Longer

Superior workmanship and finish in heavy-gauge metal assures installations of lasting beauty. Most designs stamped in any thickness, up to one-fourth inch, from any metal. Catalog No. 36 illustrates all designs and gives complete working data. Free on request.

Diamond Manufacturing Co.
Box 41 Wyoming, Pa.

Sales representatives in all principal cities

St., Brooklyn 5, N.Y. To be given on Tuesday evenings during October and November, the sessions will cover: radiant heating in contemporary architecture, October 13; design standards, October 20; engineering design and installation, October 27; controls, November 3; the builders' and owners' viewpoint, November 10; and research and development, November 17.

IBR SCHOOL OF MODERN HEATING — Fall and early winter schedule includes schools in Springfield, Mass., October 13-15; Reading, Pa., October 20-22; Charleston, W. Va., October 27-29; Canton, Ohio, November 4-6; Scranton, Pa., November 17-19; Providence, R.I., December 1-3. Tuition is $28. Those wishing further information may obtain it from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.

41st NATIONAL SAFETY CONGRESS AND EXPOSITION—October 19-23, Chicago. Sessions on industrial safety are scheduled for the Hilton, Congress, Morrison and Hamilton hotels. Further information is available from R. L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11.

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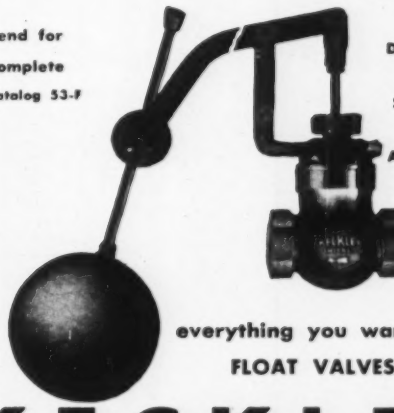

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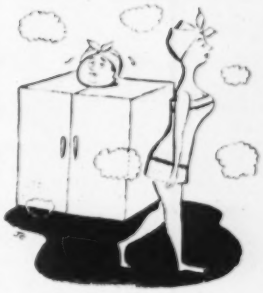

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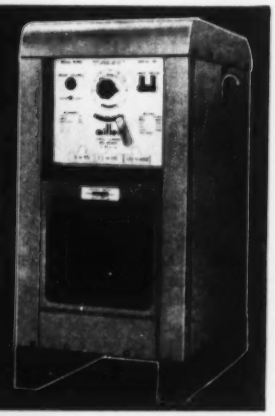
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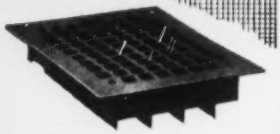
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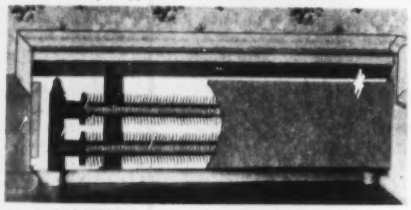
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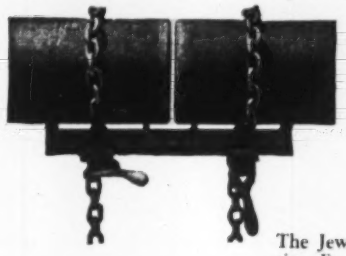

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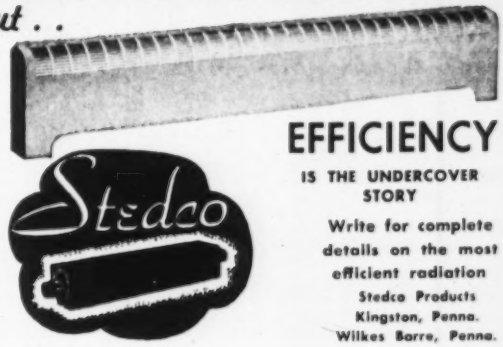

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in 25 years....

2,228,460,000,000
cubic feet of air delivered!

without major mechanical difficulty of any kind

EVERY CLARAGE FAN
EVERY CLARAGE WASHER
STILL ON THE JOB!

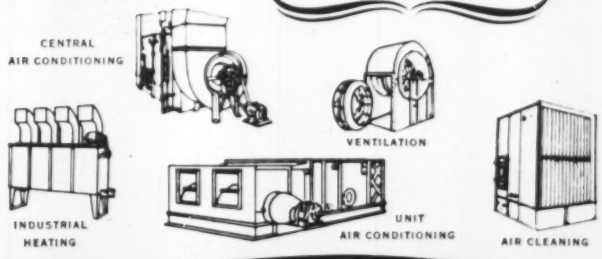
In June 1928, Fidelity-Philadelphia Trust Company, placed in operation its Clarage equipment —40 fans and 4 air washers.

Today the same 40 Clarage fans and the same 4 Clarage washers provide efficient, dependable ventilation for this great office building —and they are apparently good for another quarter-century of service.

In handling over two and one quarter trillion cubic feet of air, not a single replacement has been made, nor a single major mechanical difficulty encountered.

Thanks to adequate maintenance on the part of Fidelity management, this Clarage equipment has had the opportunity to prove our slogan: **"You can RELY on Clarage"—RELY on Clarage to cost you far less in the long run.**

Write us about your air handling and/or air conditioning needs...CLARAGE FAN COMPANY. Kalamazoo, Michigan.



You can Rely on...

CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA Canada Fans, Ltd., 4285 Richelieu St., Montreal

the *AUTOMATIC* answer to DIVERSIFIED TEMPERATURE REGULATION PROBLEMS . . .

JOHNSON CONTROL

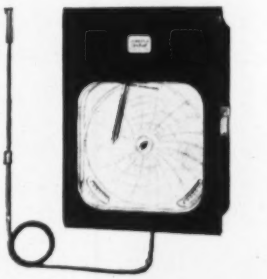
Owens-Corning Fiberglas Corp., Anderson, South Carolina. Lockwood-Greene Engineers, Inc., architects and engineers, New York and Spartanburg, S. C.; Carrier Corporation's Atlanta Office, air conditioning contractors.

Cloth from sand? Yes! That is what happens at the Owens-Corning Fiberglas plant at Anderson, South Carolina. Here, temperature and humidity conditions throughout the entire plant are controlled by Johnson.

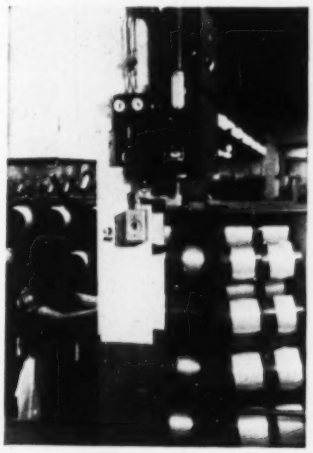
The Carrier centrifugal refrigeration machine, which furnishes the chilled water for cooling in connection with the air conditioning, is under the control of a Johnson T-1000 Single-Pen *Record-O-Stat*. In addition to acting as an accurate temperature controller, this instrument also insures that a continuous record of the temperature of the chilled water is always available for reference. This is important where industrial processes are dependent upon the space conditions. In the forming and finishing rooms, space temperatures are maintained at precise levels by Johnson T-800 Master and T-901 Submaster Thermostats which operate Johnson Valves and Damper Operators.

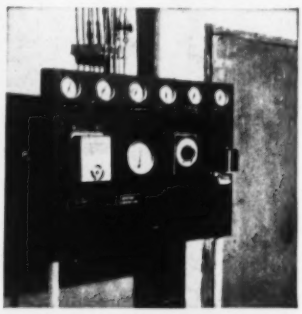
Finishing rooms, offices, cafeteria, shops, first aid room, kitchen and locker rooms are controlled by Johnson *Individual Room* Thermostats. All of the Johnson apparatus, engineered for the most exacting results, is combined into a complete Planned-for-the-Purpose, Installed-for-the-Purpose Control System. Another outstanding example of the adaptability of Johnson Control!

Whether *your* plant calls for the solution of intricate temperature and humidity control problems or merely the simple application of a single controller, call a Johnson engineer from a nearby Branch Office and get the benefit of over 60 years of experience offered by the *only* nationwide organization devoted exclusively to manufacturing, planning and installing automatic temperature and air conditioning control systems. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.



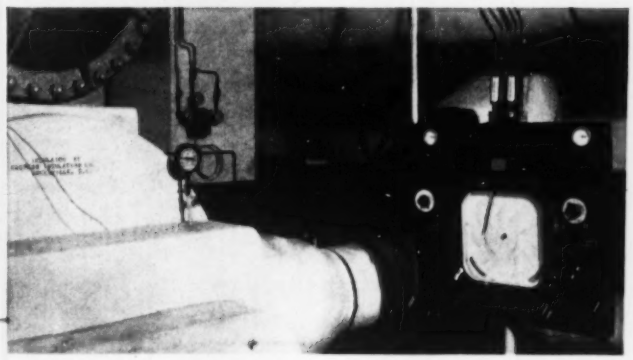
T-1000 Single-Pen *Record-O-Stat*





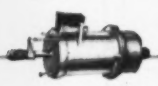
Temperatures in manufacturing and other areas are controlled by Johnson T-400 series Room Thermostats, one of which is shown above.

From control panel at left, a Johnson T-800 Thermostat controls the dew-point temperature of air leaving the air washer for the air conditioning unit serving a processing area.



Above, a Johnson T-1000 *Record-O-Stat* regulates and records the temperature of the chilled water leaving the Carrier centrifugal refrigeration machine.

V-104 Coil Valve



D-265 Damper Operator with Pilot Positioner

T-403 Room Thermostat

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885